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UNITED STATES TARIFF COMMISSION  
WASHINGTON



✓ INFORMATION CONCERNING  
THE POTASH INDUSTRY

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WASHINGTON  
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1919



UNITED STATES TARIFF COMMISSION  
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WASHINGTON  
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1919

## **UNITED STATES TARIFF COMMISSION.**

**Office : 1322 New York Avenue, Washington. D. C.**

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**LETTER OF TRANSMITTAL.**

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UNITED STATES TARIFF COMMISSION,  
Washington, June 7, 1919.

*The Committee on Ways and Means of the House of Representatives:*

I have the honor to transmit herewith, in accordance with your request, information compiled by the United States Tariff Commission on the potash industry.

Very respectfully,

THOMAS WALKER PAGE,  
*Vice Chairman.*



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## THE POTASH INDUSTRY.

### INTRODUCTORY STATEMENT.

#### THE SITUATION AND THE TARIFF PROBLEM.

The potash industry presents one of the most complex tariff problems in the chemical schedule. For several years before the outbreak of the European war, imports of potash salts into the United States had averaged about 1,000,000 tons valued at a little less than \$15,000,000.<sup>1</sup> Since the various potash salts on the market differ greatly in the proportion of potash content, it is convenient to follow the practice of the fertilizer trade in considering the weight of "actual potash" or oxide of potash ( $K_2O$ ).<sup>2</sup> The normal prewar consumption of the United States may be taken as approximately 270,000 short tons of actual potash per year.

*Actual potash ( $K_2O$ ) content of potash salts imported for consumption in the United States, 1905-1917.*

[From Mineral Resources of United States, 1917.]

Year.	Short tons.	Year.	Short tons.
1905.....	129,684	1912.....	263,975
1906.....	155,974	1913.....	270,720
1907.....	144,351	1914.....	207,060
1908.....	136,057	1915.....	46,967
1909.....	173,220	1916.....	7,925
1910.....	279,780	1917.....	8,120
1911.....	274,446		

Over 99 per cent of the imports came from Germany which held an almost complete monopoly of the world's trade in potash salts, because of inherent geological and geographical advantages. At the outbreak of the war there was no potash industry in the United States. The urgent need for potash for fertilizer, munitions, matches, and various chemical purposes caused a rise in price to about ten times normal and this in turn has resulted in the creation of the new American industry. Seventy-eight firms were engaged in the production of potash compounds in the United States during 1918. The output of these firms for the year was 192,587 short tons of crude material containing 52,135 short tons of actual potash.

Is this new industry destined to be permanent? The problem is complicated by the fact that the American supplies of potash come from many sources and by different processes. In some cases the potash is a by-product of other industries; in others, it is the primary product.

<sup>1</sup> Average 1911-1914 fiscal years, inclusive, 997,000 tons valued at \$14,612,000; 1914 fiscal year, 1,085,000 tons valued at \$16,350,000.

<sup>2</sup> The German potash salts customarily imported for use in making mixed fertilizers varied from 12.4 to 50 per cent of actual potash.

In the following pages an attempt is made to present some of the facts likely to be most significant in determining the fate of the new industry. The peace terms are certain to have a large influence. There are deposits in Alsace which equal the great German deposits at Stassfurt in quality, and although much smaller than the Stassfurt deposits, are nevertheless large enough to supply the world's needs for many decades. With France in control of Alsace, sharp competition and lower prices for potash salts may be anticipated. If tariff bargaining or economic agreements play any part in the peace negotiations, the potash industry will loom large. The American industry has at least demonstrated that a German threat to withhold supplies need have no terrors.

If Germany is forced to pay a large war indemnity, part of the payment must be accepted in form of potash salts, even if the indemnity is nominally payable in gold.

#### SITUATION BEFORE THE OUTBREAK OF THE WAR.

The salts of potash and of soda are so similar that for nearly all purposes except fertilizer one can be substituted for the other. In many cases the soda salt is both better and cheaper. In others, the potash salt is used because it has an advantage sufficient to counterbalance the prevailing difference in price. Until about 1800, potash was obtained entirely from wood ashes. It was cheaper and more plentiful than soda, then obtained exclusively from the ashes of seaweed. The glass and soap made at that time were chiefly potash glass and potash soap. The development of the Leblanc process for making soda from salt during the first quarter of the nineteenth century made soda cheaper than potash, and the result was that the consumption of soda increased more rapidly than that of potash. About 1857 large deposits of soluble potash salts were discovered underlying an extensive area in central Germany. In 1860 the usefulness of these salts as fertilizer was discovered, and in 1861 the first factory for refining the crude salts was erected.

The rapid growth of the industry is shown by the following figures for the output of the German mines:

#### *Production of potash salts in Germany.*

[In terms of actual potash ( $K_2O$ )<sup>1</sup> expressed in metric tons of 2,204 pounds.]

Year.	Metric tons.	Year.	Metric tons.
1870.....	30,000	1913.....	\$1,110,274
1880.....	68,560	1914.....	\$1,904,137
1890.....	122,302	1915.....	\$1,679,755
1900.....	303,610	1916.....	\$1,883,096
1910.....	857,883	1917.....	\$1,004,285
1911.....	939,927		

<sup>1</sup> The actual weight of crude salts mined is about ten times the figures here given, since the crude salt averages about 10 per cent of actual potash.

<sup>2</sup> Sales according to Frankfurter Zeitung July 10, 1918, published in Commerce Reports Oct. 9, 1918.

More than one-half of the total is consumed in Germany and a little less than one-quarter in the United States.

The potash in these German deposits exists in the form of the minerals, sylvinitite (potassium chloride or muriate), carnallite (double chloride of potassium and magnesium), kainite (double

sulphate of potassium and magnesium), associated with common salt, anhydrite (calcium sulphate), and kieserite (magnesium sulphate), some bromides and borates, and many other minerals of minor importance. A German geologist has estimated that the supply is sufficient to provide for a consumption of 5,000,000 tons per year for 600,000 years.

The salts are mined by methods similar to the methods of mining coal, and the costs, therefore, probably approximate the cost of coal mining. Much of it, especially the kainite, is put in the market for fertilizer without other treatment than grinding and bagging. Imports of kainite into the United States averaged about 500,000 tons per year.

Carnallite is present in the deposits in abundance and is the material from which the muriate is made by a simple and cheap process involving primarily crystallization from water.

The industry is controlled by a syndicate in which the Prussian Government is a partner. The syndicate has been supported by the German Government to the extent of compelling all mines to join it. The price of potash salts has been maintained much above a competitive price, but low enough to keep an almost complete monopoly of the world's markets.<sup>1</sup>

*Total quantities of crude salts extracted from mines of the German Potash Syndicate.<sup>1</sup>*

Year.	Carna-	Kiese-	Kainite,	Sylvinitc,	Total.
	llit.	rite.	hartalsz., and schonit.		
1890.....	838,526	6,951	401,870	31,916	1,279,264
1895.....	782,944	3,012	669,531	76,097	1,531,585
1900.....	1,097,803	2,047	1,189,394	147,791	3,037,035
1901.....	1,860,189	2,395	1,432,136	190,031	3,484,194
1902.....	1,705,664	1,821	1,354,528	188,820	3,250,834
1903.....	1,844,030	1,583	1,582,867	196,140	3,121,597
1904.....	1,911,166	1,055	1,906,823	231,455	4,053,499
1905.....	2,239,708	2,730	2,405,500	230,621	4,878,598
1906.....	2,263,197	9,190	2,751,021	254,913	5,311,552
1907.....	2,534,788	10,359	2,788,953	304,143	5,638,261
1908.....	2,768,793	18,473	2,921,712	305,282	6,014,201
1909.....	3,280,726	7,387	3,264,290	344,749	6,901,153
1910.....		3,582,885		4,577,893	8,160,778
1911.....		4,411,664		5,284,813	9,706,507
1912.....		5,281,612		5,784,371	11,070,014
1913.....		5,302,350		6,305,100	11,607,510

<sup>1</sup> Federal Trade Commission report on the fertilizer industry.

In recent years a deposit similar to the Stassfurt deposit has been discovered near Muhlhausen, Alsace. Production on a commercial scale from this source began in 1912, but the mines have been controlled by the syndicate.

The German deposits were, at the outbreak of the European war, the only known deposits which were soluble in water and present in solid form. They are readily available for use as fertilizer and for industrial purposes. These deposits have given the control of the world's potash trade to Germany.

<sup>1</sup> See Tosdal Quarterly Journal of Economics, vol. 28, pp. 140-190, and Report on the Fertilizer Industry, pp. 104-119, published by Federal Trade Commission, 1916.

**SIGNIFICANCE OF POTASH IN AGRICULTURE AND IN CHEMICAL INDUSTRIES.**

Compounds of potassium or potash, as it is commercially called, occur in great abundance and widely scattered areas. F. W. Clarke, of the United States Geological Survey, estimates that 3 per cent of the outer 10 miles of the earth consists of the element potassium. All but a small fraction of this enormous amount of potash occurs in the mineral feldspar and other silicate rocks. The ocean contains soluble potash salts in enormous aggregate amounts, but in such dilute solution that very little has been recovered commercially from this source.

Potash in the form of feldspar and other silicate rocks is insoluble and not directly available for agricultural or chemical uses. Feldspar is a complex silicate of potassium, sodium, and aluminum in which the potash is held in such firm chemical combination that large amounts of energy are necessary to decompose it. Any process of decomposing feldspar is, therefore, necessarily more expensive than the utilization of the readily soluble potash salts from the German deposits. Many attempts have been made to recover potash from feldspar, but none have successfully competed with potash from other sources. There is no hope that such a process of decomposing feldspar can be successful in competition with the other sources of potash unless the aluminum and silica are recovered in salable form (as Portland cement, or as pure oxide of aluminum or metallic aluminum) and of a value sufficient to offset the high cost of the process which makes the potash in a sense a by-product.

Potash is present in all tillable soils and is essential to the growth of all plants. In the form of feldspar, it is insoluble and not directly available to plants. Feldspar in soil, however, decomposes, even though slowly, gradually making the potash available. The process requires centuries for completion, and thus maintains the fertility over long periods. The productiveness of some soils is limited by the available or soluble potash content. On such soils the addition of potash salts, which are soluble and therefore readily available to plants, may increase the value of the crop by an amount greater than the cost of the added potash salts. The question of whether the use of fertilizer containing potash is an economic advantage depends on the nature of the soil, the crop to be grown, the cost of the potash, and the price received for the crop. Potash is especially needed on muck soils; its addition to the black loam of the middle western prairies is, however, unnecessary and of doubtful economic advantage, especially for grain crops. The crops which show the greatest need of potash are cotton, potatoes, tobacco, and citrus fruits. In the United States the cotton crop needs and has in the past taken by a substantial margin more potash than any other crop. Some soils in the cotton-growing section yield good crops without the addition of potash, but a large proportion of the cotton-growing area is greatly benefited by its use. The lack of potash in the soil can not be compensated for by the addition of other fertilizers. Phosphates, nitrates and lime, or other fertilizer material serve a distinct and largely independent function in the growth of the plant. The greatest market for potash in the United States has been in the South Atlantic States.

Germany has consumed more potash than all the rest of the world combined. The German Potash Syndicate has been active in stimulating the sale of potash throughout the world by means of advertisements, demonstration farms, and exhibits.

Potash salts are also used for many industrial purposes, but before the war these uses probably consumed only about 5 per cent of the total. For all of these industrial purposes (but not for fertilizer) the potash salt competes with the corresponding soda salt. The potash salt will only be used if it has a special advantage which justifies the payment of a higher price. Since the outbreak of the European war the difference in price between the potash and soda salts has increased. This has caused a marked substitution of potash salts by soda salts in many cases.

Although most glass is soda glass, potash (as carbonate) is used for certain varieties of glass, especially cut-glass tableware (flint glass), electric-light bulbs, and certain varieties of optical glass. Potash tends to give the glass a lower melting point and a higher refractive index than soda.

The consumption of soda in making soap far exceeds the consumption of potash, but potash (as hydroxide) is used in some varieties of soap, especially wool-scouring soaps.

There are a number of other salts of potash which are preferred for use in the chemical industries to the corresponding soda salts, because the potash salt is more readily crystallized or shows less tendency to become moist by absorption of water from the air. This is true of the permanganate, chlorate, and perchlorate, bromide, iodide, chromate and bichromate, ferrocyanide and nitrate. (See p. 20, for discussion of the uses of the salts.) The differential advantage of the potash salt over the soda salt varies greatly in different cases, and therefore the difference in price which consumers are willing to pay varies according to the use the soda or potash salt is to serve. At one time cyanide was usually marketed as the potash salt, but the soda salt had practically driven potash cyanide out of the market even before the outbreak of the war.

#### DEVELOPMENT OF THE INDUSTRY IN THE UNITED STATES FROM BEGINNING OF THE WAR TO SIGNING OF THE ARMISTICE.

At the outbreak of the war the United States, in common with the rest of the world, was practically dependent on Germany. Imports into the United States for the fiscal year ending June 30, 1914, had been the greatest on record, a total of 1,085,004 tons, valued at \$16,350,019. During the second half of 1914 imports continued, although in greatly reduced volume. At the end of 1915, Germany put an embargo on the further exportation of potash salts. This was followed by a rapid advance in the price. The grade of muriate of potash commonly used for fertilizer (80 to 85 per cent pure), which had sold in New York at \$39.07 on July 1, 1914, rose to \$230 on July 1, 1915, and to \$475 on January 1, 1916. Crude carbonate of potash, which was worth 3 cents and a fraction per pound at the outbreak of the war, rose to 20 cents by the middle of 1915 and to 50 cents by the end of 1915.

As a consequence of the shortage and high prices for potash salts the creation of an American potash industry aroused keen interest.

During 1915 there was great activity in experimental work and in the erection of plants for the production of soluble potash salts from American sources. The actual output during 1915 was, however, very small, certainly less than one-half per cent of our normal consumption. Many of the projects started in 1915 reached the stage of commercial production in 1916. The production during 1916 was, however, only about 4 per cent of the normal annual consumption. During 1917 the production increased to about 12 per cent, and in 1918 to about 20 per cent of the normal prewar consumption. The development has been carefully followed by the United States Geological Survey, which has published a detailed report of the condition of the industry during 1915, 1916, and 1917, and a preliminary announcement of the production during 1918.

#### DOMESTIC PRODUCTION, 1916-1918.

The following account is a summary of the more detailed discussion of the industry contained in the report, "Potash in 1916," prepared by Hoyt S. Gale, and "Potash in 1917," prepared by Hoyt S. Gale and W. B. Hicks of the United States Geological Survey:<sup>1</sup>

The manufacturers of potash salts and potash products in the United States reported a production in 1916 of 35,739 short tons, having a mean content of about 27 per cent of potash ( $K_2O$ ), and a total content of 9,720 short tons of potash ( $K_2O$ ). This is almost exactly ten times the production reported for 1915.

*Potash produced in the United States, classified according to source.*

**1916.**

Source.	Available potash ( $K_2O$ ).	
	Quantity (short tons).	Value at point of shipment.
Natural salts or brines.....	3,984	\$1,937,600
Alunite and silicate rocks, including recoveries through furnace dust.....	1,850	715,000
Kelp.....	1,556	781,100
Wood ashes (potash pearlash).....	1,412	270,000
Distillery waste (molasses).....	1,845	500,900
Miscellaneous organic sources.....	63	38,130
Total.....	9,720	4,242,730

<sup>1</sup> The reported production from wood ashes amounted to 825 tons of salts of varying grades, containing about 50 per cent of potash.

The output of all potash materials produced and marketed in the United States in 1917, as reported by the manufacturers to the United States Geological Survey, was 126,961 short tons, which contained 32,573 short tons, or an average of 26 per cent of pure potash ( $K_2O$ ). This is more than three times the quantity produced in 1916.

<sup>1</sup> Published in the Mineral Resources of the United States, Pt. II, pp. 73-171.

## THE POTASH INDUSTRY.

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*Potash produced in the United States, classified according to source—Continued.*

1917.

Source.	Number of producers.	Total production.	Available potash ( $K_2O$ ).	Value at point of shipment.
Mineral sources:		<i>Short tons.</i>	<i>Short tons.</i>	
Natural brines.....	10	79,876	20,652	\$8,261,873
Alunite (refined salts and crude and roasted alunite).....	3	7,153	2,402	892,763
Dust from cement mills.....	8	13,552	1,621	700,523
Dust from blast furnaces.....	3	2,133	185	68,841
Organic sources:				
Kelp.....	10	11,306	3,572	2,114,815
Molasses residue from distilleries.....	4	8,589	2,846	1,130,907
Wood ashes.....	49	1,035	621	549,150
Evaporated Steffens water from sugar refineries.....	5	12,642	369	147,830
Evaporated wool washings and miscellaneous industrial wastes.....	3	645	305	113,875
Total.....	95	126,961	32,573	13,980,577

<sup>1</sup> Includes 1,333 tons of material produced but not sold in 1917.

A preliminary report for 1918 shows that the output gained 60 per cent over the output during 1917.

1918.

Source.	Number of producers.	Total production.	Available potash ( $K_2O$ ).
Natural brines.....	21	<i>Tons.</i>	<i>Tons.</i>
Alunite.....	4	147,125	39,255
Dust from cement mills.....	9	6,073	2,619
Kelp.....	6	11,739	1,429
Molasses distillery waste.....	4	14,456	4,292
Steffens waste water.....	5	9,505	3,322
Wood ashes.....	26	2,818	761
Other sources.....	3	609	365
	78	192,587	52,135

*Potash produced in the United States in 1918, classified according to product marketed.*

Product marketed.	Total production.	Variation in content of $K_2O$ .	Average content of $K_2O$ .	Available ( $K_2O$ ).
Muriate.....	<i>Tons.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Tons.</i>
Low-grade chloride.....	30,127	38.0-58.5	41.8	12,614
Sulphate.....	6,559	10.0-20.0	13.6	894
Crude sulphate and carbonate.....	6,672	25.0-51.0	47.9	3,188
Crude carbonate and caustic.....	122,741	18.0-38.0	25.5	31,311
Potash char, ash, and ground kelp.....	809	50.0-78.0	60.0	365
Cement and blast furnace dust alum, raw and calcined alunite.....	14,630	12.0-42.5	19.8	2,896
	11,249	2.5-13.0	7.7	867
	192,587	.....	.....	52,135

## SOURCES OF AMERICAN POTASH.

## NATURAL SALTS AND BRINES.

The greatest output has been secured from natural salt deposits and brines. The first large production came from various alkali lakes in the sand-hill region of western Nebraska. The brine of these lakes

contains mixed sulphates, carbonates and chlorides of sodium, and potassium. The brine is pumped by pipe line to the railroad station where the water is driven off by heat and the mixed salts recovered. During 1917 no attempt was made to purify or to refine the salts obtained; they were shipped in a crude form containing about 20 or 30 per cent of potash. These lakes have taken the lead in the production of potash in the United States, but they will probably be surpassed in the future by Searles Lake, Calif., and the Salduro Salt Marsh, Utah.

The Searles Lake deposit has been described in detail in a report published by the United States Geological Survey, from which the following brief sketch of its main features is taken:

Searles Lake is really not a lake at all: it is essentially a deposit of crystalline salts the surface of which is practically dry a considerable part of the year. This so-called lake occupies the bottom of a basin-like valley which in prehistoric time contained a large and deep lake. After this ancient lake had dried, the salts that had been in solution in its waters were left on its bottom; so that now, when nearly all the surface water has disappeared, the most striking feature of the whole basin is the central level plain of white crystalline salts, which covers about 12 square miles. This salt plain is occasionally flooded by storm water, but during the dry season the water rapidly disappears. The salt itself is permeated by a thoroughly saturated brine, which maintains a practically constant level very close to the surface of the salt plain.

The many wells that have been bored into and through this deposit show that the salts average 60 to 75 feet in thickness, and reach a maximum thickness of about 100 feet. The crystallized mass forms a great, somewhat irregular, lens which gradually becomes thinner toward the edges. These edges extend far out under the surface of the marginal mud zone, so that the deposit contains a much greater quantity of salts than could be determined prior to the extensive campaign of drilling that has now been carried out. The crystallized salts are evidently disposed in essentially horizontal layers and differ somewhat in composition at different depths in the deposit. The surface consists mainly of sodium chloride and has been called the "halite" zone. At a depth of about 15 feet there is commonly found a layer of an unusual and very distinctive mineral called hanksite, which is found also with many drillings taken from points below this depth. The salts associated with the hanksite contain more or less sulphate, although these also contain much sodium chloride. Toward the bottom of the deposit layers of crystalline sodium carbonate in the form of the mineral "trona" are found, and at the bottom there is usually a layer or zone of "trona." The salts that are thus buried in an underground lake of brine are difficult to get out and no active steps have been taken for their recovery in the solid form.

The brine that permeates the whole deposit is now considered its principal valuable constituent. It is a saturated solution of the crystallized salts, but it contains more potash and borax. It is to a certain extent a natural "bittern" or "mother liquor," although the term bittern is not strictly applicable to a solution that contains no salts of magnesia. It is undoubtedly the liquor that remained after the crystal salts were formed by the natural concentration of the waters from the ancient lake that occupied this basin.

*Analysis of salts in brine of Searles Lake, Calif.*

Potassium chloride (KCl) . . . . .	4.02
Borax ( $\text{Na}_2\text{B}_4\text{O}_7$ ) . . . . .	1.08
Sodium carbonate ( $\text{Na}_2\text{CO}_3$ ) . . . . .	4.26
Sodium sulphate ( $\text{Na}_2\text{SO}_4$ ) . . . . .	6.40
Sodium chloride (NaCl) . . . . .	17.18
Total . . . . .	32.94
Total determined . . . . .	33.30

Probably no satisfactory means has been devised to determine the proportion of brine to crystalline salts in the deposit, but it is undoubtedly large. The salt crust itself is a porous mass through which the brine flows so readily that the proportion of pore space, and consequently of brine, must be considerable. The original estimate of the Geological Survey that this pore space constitutes at least one-fourth of the volume of the deposit seems to be moderate. Continued pumping has shown only slight changes in the brine level, which quickly readjusts itself.

This deposit contains relatively more borax than the Nebraska deposit. It is being developed by two companies, but the production has been delayed by legal and technical complications. The production during 1916 was, therefore, small, but there can be little doubt that the output will surpass the Nebraska lake district. The companies plan to separate the salts by a suitable refining process and to sell refined potassium chloride with other salts as by-products, especially borax, soda, sodium sulphate, and sodium chloride.

The Salduro, Utah, brine contains sodium, potassium, and magnesium chlorides, but very little sulphate and no carbonate or borate. This deposit resembles the German deposits more closely than any found in the United States. One great drawback in the operation of this plant is that all the water needed must be brought to the plant in tank cars. No production was secured during 1916, but the plant may become one of the largest producers in the country.

There are also three companies extracting potash from the water of the Great Salt Lake, which resembles ocean water in the proportion of the dissolved salts, but which is nearly six times as concentrated. A small output has also been secured from ocean water as a by-product of salt making. All of these plants are at a great distance from the South Atlantic States, the greatest market for potash salts. None of them furnish a raw material as concentrated or as pure as the German potash deposits, and many of them are hampered by lack of water. The total amount of potash available in all of these saline deposits now known is probably only a fraction of 1 per cent of the amounts available in Germany.

During 1917, 79,876 short tons of crude potash salts containing 20,652 short tons of actual potash were produced from natural brines by 10 establishments. During 1918 the number of producers of potash from natural brines had risen to 21, with an output of 147,125 tons of crude salts containing 39,255 short tons of actual potash.

#### ALUNITE.

Alunite is a mineral which is essentially a double potassium aluminum sulphate, which is insoluble in water. It is first heated to a red heat which decomposes the alunite and makes the potash soluble and the aluminum insoluble. The roasted mineral is leached with water and potassium sulphate recovered by evaporation. Commercial production has come almost entirely from mines near Marysvale, Utah. This deposit is not advantageously located, being about 6 miles from the nearest railroad and in a section of the country remote from any market. That potash can be produced from this source at a cost to compete with the German potash seems improbable unless processes can be devised which recover the aluminum oxide also in marketable form.

#### DUST FROM CEMENT MILLS.

Probably the most promising of all the attempts to recover potash is as a by-product of Portland cement mills. The flue dust from Portland cement mills has long been an annoyance. The first mill to install an effective device to collect the dust was the Riverside Portland Cement Co., of Riverside, Calif. The cement dust settled on

oranges in its vicinity and made them unsalable. The owners of the orange groves brought damage suits against the Riverside Portland Cement Co. which compelled it either to abate the nuisance or close the mill.

A Cottrell electrostatic dust precipitator was installed which proved to be highly efficient. The dust collected was found to be rich enough in soluble potash salts to be valuable and salable as a fertilizer. Later the quality of the product was improved by leaching the dust with water and recovering a high grade potash salt by crystallization. A nuisance was thus converted into a profitable by-product. It was then found that the yield of potash could be increased by adding a small proportion (up to 3 per cent) of feldspar to the cement raw material. It has also been found that the addition of a small amount of salt increases the liberation of potash from the cement. Fortunately the operative conditions most favorable for potash recovery are also most favorable for the production of cement of the best quality. The Security Cement & Lime Co., of Hagerstown, Md., was the second company to install the Cottrell dust-collection system, and also secured a marked success, both technically and financially. This plant started operations toward the end of 1916. By the close of 1917 six additional plants were in operation, and by the end of 1918 the process was in operation at nine cement mills. In 1918 the output was 11,739 tons of crude dust containing 1,429 tons of actual potash.

The permanency of this branch of new potash industry seems reasonably assured. The operating costs are low. It seems improbable that potash prices will go so low in the future that the value of the product will fall below operating expenses.

The demonstrated technical success of the process is likely to result in legal pressure on all cement mills to compel the installation of the necessary equipment to abate the dust nuisance to the surrounding country. Under these circumstances the potash will be collected and sold for whatever it will bring, regardless of whether the returns are greater or less than the operating cost. It has been estimated by the Department of Agriculture that if this equipment were installed at all of the cement mills in the United States, the yield would be 75,000 tons of actual potash ( $K_2O$ ), or nearly one-third of the normal prewar consumption.

#### DUST FROM BLAST FURNACES.

There is a possibility that potash may be secured as a by-product in the pig-iron blast furnace. The raw materials fed into the blast furnace contain a minute percentage of potash, but the aggregate amount is large. Under the usual process, 80 per cent of this potash is volatilized in the furnace and passes out with the gases from the top of the furnace. The gases are then washed with water to remove most of the dust and are then burned in hot blast stoves or under boilers. Most of the potash is irretrievably lost in these wash waters, which are too dilute to permit the profitable recovery of the potash. However, a part escapes the washers and gradually accumulates in the stoves and boilers from which it must be cleaned out periodically. This dust contains sufficient potash to make it salable as fertilizer. During 1917 three companies only were selling this dust. The amount of actual potash ( $K_2O$ ) contained in the dust sold was only 185 tons.

Experiments to develop a dry method of collecting the dust have been made with considerable promise of success. A systematic study of iron ores and fluxes has been made by the Department of Agriculture, and actual experiments have been made by the Bethlehem Steel Co. and United States Steel Corporation. This work indicates that there is not sufficient potash in the Lake Superior iron ores to make its recovery profitable, but that the southern ores, Cuban ores, and ferromanganese ores contain sufficient potash to make its commercial recovery a promising prospect. If successful an output of 20,000 tons of actual potash from this source may be hoped for.

#### KELP.

A great deal of attention has been given to the production of potash from kelp. The output of the nine companies which reported production during 1916 was 1,556 tons of actual potash ( $K_2O$ ). During 1917 there were 10 companies in operation with an output of 11,306 short tons of crude material containing 3,572 tons of actual potash ( $K_2O$ ). During 1918 the number of producers dropped to six, but the output increased to 14,456 tons of crude salts containing 4,292 tons of actual potash. Kelp is a giant seaweed that grows along the Pacific coast of the United States. It has an exceptional power to absorb potash from sea water. The air-dried kelp contains from 10 to 15 per cent of actual potash, chiefly in the form of the muriate, together with a little more than 1 per cent of ammonia and a little less than 1 per cent of phosphoric acid, both of which have fertilizer value.

An estimate prepared by F. K. Cameron, of the Department of Agriculture, in 1915, was to the effect that the annual growth of kelp contains more than five times the prewar consumption of potash in the United States. Recent experience of the industry, however, indicates that these estimates are many times too great and that much of the kelp can not be commercially harvested.

When the industry first started there was no control over the harvesting of the kelp, but anyone was free to cut the kelp when and where he pleased. As the industry developed this plan resulted in difficulties. There proved to be insufficient amounts conveniently accessible to the factories, and the resulting rivalry resulted in excessive and premature cutting.

The California Legislature passed a bill putting control of the kelp beds in the hands of the California Fish and Game Commission and imposing a tax on the kelp harvested. During the winter of 1916-17 a portion of the beds were seriously damaged by a disease.

The purely technical problems of harvesting the kelp have been solved by the invention of a submarine harvester mounted on a sea-going barge, which cuts the kelp about 6 feet under the surface and loads it into the barge. The cost is said to be about \$1 per ton of wet kelp.

There are three distinct methods of marketing the product. The simplest method is to dry the kelp and then grind it to a powder, which may be sold as fertilizer. This method utilizes the ammonia and phosphoric acid for fertilizers also; it has the great drawback,

however, that over 80 per cent of the dried product is valueless and the cost of shipment, therefore, probably will prevent its distribution except in local markets.

The second method is to heat the dried kelp to a low red heat, thereby charring it and driving off much of the useless organic matter. The product is a "kelp char" containing about 30 per cent of potash. In the future, arrangements will probably be made to collect volatile by-products, but little has been accomplished along these lines yet. The "kelp char" may be sold for fertilizers as such or it may be leached with water to extract the potash salts. A high-grade potash salt may be recovered by crystallization. The process is used in several plants operated by private firms and also in a plant built and operated by the Department of Agriculture. It is planned to carry out extensive experimental work in this Government plant for the purpose of developing the best methods of treatment and for the recovery of all possible by-products. The most important of these by-products probably will be iodine, a high-priced material not produced in the United States.

A third process is to decompose the wet kelp by fermentation. By this method the vegetable matter is largely converted into acetic acid with small amounts of butyric and propionic acids. This process has been adopted primarily to secure the acetic acid, for which there was a great demand in the manufacture of explosives. After fermentation, the liquid is filtered and the salts are separated by evaporation and crystallization. The potash salts are really a by-product rather than the main product of this reaction. The potash is marketed in the form of a high-grade muriate of about 97 per cent purity. Other by-products include iodine, ethyl butyrate, and ethyl propionate. The process was devised and the plant built by the Hercules Powder Co. as a result of an offer by the British Government of a contract for the explosive cordite at a high price, but with the provision that the acetone needed to make the explosive should not be obtained from any known source, but should be obtained by a new plant and new process. This plant was shut down soon after the signing of the armistice.

It is not probable that potash can be commercially recovered from kelp when normal conditions are restored, except, perhaps, for purely local use. In fact, several of the plants shut down within a few months after the signing of the armistice before any German or Alsatian potash reached the American markets.

#### MOLASSES DISTILLERY WASTE.

Potash has been obtained as a by-product from distilleries utilizing molasses as raw material. The potash is contained in the juice of the sugar cane and is concentrated in the molasses when the sugar is crystallized. The molasses is then fermented and the alcohol produced distilled. The potash remains in the residue in the stills. In the past the residue has usually been discarded. The high prices which have recently prevailed have made it possible to recover the potash profitably by evaporation and crystallization. It is not to be expected that this operation will be continued when normal prices again prevail. During 1918 four firms produced 3,322 tons of actual potash from this source.

Molasses contains about 4 per cent of potash. The Geological Survey estimated that if all the potash were recovered from the molasses fermented and distilled in the United States about 30,000 tons of potash would be obtained.

A small production has been secured as a by-product of the beet-sugar industry, the potash being recovered from waste liquor from which the sugar has been removed as completely as possible. In 1918, five firms produced 2,818 tons of crude material containing 761 tons of actual potash ( $K_2O$ ).

It is estimated that the sugar beets grown annually in the United States contain 18,000 tons of potash. It is obvious that potash as a by-product of the sugar industry offers no hope of a real solution of potash shortage. Even if the recovery of the potash were complete, all of it would have to go back to the fields from which it was taken in order to maintain their fertility, and no surplus would be left for other crops.

#### WOOD ASHES.

Wood ashes at one time furnished the only commercial source of potash salts, and this source has been revived on a small scale. The potash obtained from this source is a by-product of lumber mills or woodworking establishments using hardwoods. The sawdust and scrap is usually burned as fuel. The ashes are rich in potash. The wood ashes may be used directly as fertilizer or a more concentrated salt may be made by mixing with lime and leaching with water, followed by evaporation. The product is a mixed carbonate and hydroxide which is used for chemical purposes. There were 49 plants which produced potash from these sources in 1917, the output of which was 1,035 tons of crude material containing 621 tons of actual potash. The recovery of potash from wood ashes in 1918 was less than in 1917. In 1918, 26 firms produced 609 tons of crude potash containing 365 tons of actual potash. The output per plant is small. The industry is centered around the hardwood lumber districts of Michigan and Wisconsin. There is no prospect that the output will become large enough to be comparable with the normal consumption of potash. A small output of 92 tons of actual potash was secured by three firms from other industrial wastes, chiefly wool scourings.

#### DEVELOPMENT IN OTHER COUNTRIES.

Probably the most important new development in other countries has been the discovery that some of the Chilean sodium nitrate deposits contain appreciable amounts of potassium nitrate. Methods suitable for the separation of the sodium and potassium nitrates have been devised and put into operation both in Chile and in the United States.

A process for the separation of the sodium and potassium nitrates has been put into operation by the Du Pont Co. and has reached an output of over 1,000 tons actual potash per year in the form of the nitrate. If this process was used by all nitrate plants it is estimated that over 100,000 tons of potash would be recovered.

Japan has also become an exporter of potash, especially the muriate and chlorate. Although little definite information in regard to the

Japanese industry is available, it is believed that kelp is the primary source of most of the potash.

There have been various reports of the discovery of deposits of potash salts resembling the German deposits in Spain and Abyssinia and of alunite deposit in Italy and Australia, but there has been very little commercial development from these sources. A beginning has been made in the recovery of potash from cement mills and blast furnaces in England, Canada, Spain, and Japan.

#### DETAILED INFORMATION CONCERNING INDIVIDUAL SALTS.

##### POTASSIUM CARBONATE AND BICARBONATE.

*Uses.*—It is used in the manufacture of soft soaps, of Bohemian and flint glass, in dyeing, and in wool washing. The bicarbonate is used in the preparation of the pure carbonate.

*Manufacture.*—Potassium carbonate was formerly obtained almost entirely from wood ashes, but now very little is produced from this means, except in Russia where there are immense forests.

Much is now manufactured from the Stassfurt salts by the Leblanc process. By this process the potash salts are mixed with powdered coal and limestone and heated in a furnace which converts them to carbonate. This carbonate is purified by solution and evaporation.

Potassium carbonate is also recovered to some extent from the distillery waste of molasses obtained from beet sugar manufacture.

*Domestic production.*—A small quantity of carbonate of potash has been produced in the United States during the war, chiefly from wood ashes.

*Imports.*—Prior to the war imports of carbonate of potash, including crude or black salts, was about 20,000,000 pounds per year and came chiefly from Germany. The import decreased during the war to a minimum of about 2,000,000 pounds in 1916. In 1918 the imports had increased to over 14,000,000 pounds and over 90 per cent of this quantity came from Russia.

##### *Imports for consumption, by fiscal years.*

##### POTASH, BICARBONATE OF.

Fiscal years.	Rate of duty.	Quantities.	Values.	Duties collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		<i>Pounds.</i>				
1910.....	25 per cent	342,456	\$16,915.00	\$4,228.00		25.00
1910.....	do	331,300	16,633.00	4,158.00		25.00
1911.....	do	325,016	16,128.00	4,107.00		25.00
1912.....	do	275,201	13,155.00	3,288.00		25.00
1913.....	do	341,045	14,245.00	3,573.00		25.00
1914.....	do	96,991	4,474.00	1,118.00		25.00
1914.....	1 cent per pound	381,362	18,293.00	1,909.00		10.44
1915.....	do	383,531	20,311.00	1,917.00		9.43
1916.....	do	2,062	614.00	10.00		1.66
1917.....	do	10,053	5,271.00	50.00		.95
1918.....	do	171,528	84,381.00	857.64		1.01

*Imports for consumption, by fiscal years—Continued.*

## POTASH, CRUDE OR BLACK SALTS.

Fiscal years.	Rate of duty.	Quantities.	Values.	Duties collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
1909.....	Free.....	<i>Pounds.</i> 9,628,966	\$324,540			
1910.....	do.....	8,407,373	263,643			
1914.....	do.....	2,599,883	52,454			
1915.....	do.....	4,076,783	83,502			
1916.....	do.....	1,540,149	53,752			
1917.....	do.....	2,810,245	233,111			
1918.....	do.....	727,588	112,235			

## POTASH, CARBONATE OF, CRUDE.

1911.....	Free.....	10,640,341	\$327,400.00		\$0.031	
1912.....	do.....	6,747,150	211,602.00		.031	
1913.....	do.....	10,063,912	295,066.00		.029	
1914.....	do.....	9,048,302	240,451.00		.027	
1915.....	do.....	8,620,504	261,341.00			
1916.....	do.....	444,241	27,689.00			
1917.....	do.....	1,069,408	185,910.00			
1918.....	do.....	13,183,741	2,928,289.00			

## POTASH, CARBONATE OF, REFINED.

1909.....	Free.....	11,009,479	\$379,392.00			
1910.....	do.....	9,036,267	303,917.00			
1911.....	do.....	11,143,144	396,728.00		\$0.036	
1912.....	do.....	11,627,209	383,958.00		.033	
1913.....	do.....	14,035,111	412,587.00		.029	
1914.....	do.....	10,421,005	368,958.00		.035	
1915.....	do.....	2,377,940	92,959.00			
1916.....	do.....	174,587	38,604.00			
1917.....	do.....	202,385	53,170.00			
1918.....	do.....	445,282	124,019.00			

*Imports by countries.*

## POTASH, CARBONATE OF, INCLUDING CRUDE OR BLACK SALTS.

[Free.]

Imported from—	1909		1910		1911	
	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.
Germany.....	12,819,188	462,370	11,186,415	384,230	15,908,275	534,865
France.....	2,320,981	66,063	2,384,244	63,686	3,468,812	88,343
Belgium.....	3,279,776	84,878	2,250,339	60,530	1,800,112	45,887
Netherlands.....	2,218,528	90,621	32,704	1,076	53,672	1,861
All other.....			1,570,700	57,923	1,569,481	53,173
Total.....	20,638,423	703,932	17,433,402	567,445	22,800,352	724,129

Imported from—	1912		1913		1914	
	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.
Germany.....	13,139,550	442,580	16,092,080	515,567	12,876,305	419,506
France.....	1,332,118	38,734	1,102,786	28,545	1,415,986	30,398
Belgium.....	1,731,020	46,608	2,252,247	56,598	2,517,034	54,876
Netherlands.....	11,427	232				
All other.....	1,611,682	51,295	2,792,336	83,035	3,794,288	109,556
Total.....	17,875,807	579,449	22,239,449	683,745	20,603,593	614,926

*Imports by countries—Continued.*

## POTASH, CARBONATE OF, INCLUDING CRUDE OR BLACK SALTS—Continued.

[Free.]

Imported from—	1915		1916		1917		1918 <sup>1</sup>	
	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.
Germany.....	8,788,653	295,719	2,305	121	.....	.....	.....	.....
France.....	85,502	2,949	358,400	3,281	.....	.....	.....	.....
Belgium.....	259,948	6,351	.....	.....	.....	.....	.....	.....
Netherlands.....	58,692	3,028	581,512	17,535	1,247,140	76,877	.....	.....
All other.....	3,811,976	113,232	1,173,070	98,812	3,252,100	395,218	.....	.....
Total.....	13,034,771	421,279	2,118,287	119,779	4,499,540	472,095	14,468,211	3,166,043

<sup>1</sup> Over 10,000,000 pounds of the total was imported from Russia.

## POTASSIUM CHLORATE.

*Description and uses.*—Potassium chlorate is a white crystalline substance which is not very soluble in cold water. It is a strong oxidizer and when mixed with sulphur and charcoal forms an explosive powder.

It is used where an oxidizer is required, as in the manufacture of matches, fireworks, percussion caps and other explosive powders. It is also used as an oxidizer in dyeing anilin black. The purified chlorate is used in medicine.

*Manufacture.*—An electrolytic process is generally used in the manufacture of potassium chlorate. A solution of potassium chloride is subjected to the action of a direct electric current in an electrolytic cell so that the chlorine and caustic potash which are formed come in contact with each other and combine to form potassium hypochlorite. The reaction is carried out at a temperature sufficiently high to cause the decomposition of the hypochlorite into potassium chlorate. The solution of potassium chlorate is withdrawn from the apparatus and the potassium chlorate is crystallized from the solution.

*Domestic production.*—In 1914 the production of potassium and sodium chlorates combined was 8,304 short tons, valued at \$1,131,316.

*Imports.*—The imports of potassium chlorate have been rather sporadic. The largest importation prior to the war was in 1913 when over 1,200,000 pounds were imported. The imports during the war have been considerably less than this quantity, until in 1918 when the import was about 1,000,000 pounds. Japan has been very active in the production of potassium chlorate during the war and it is likely that this import originated in Japan.

*Imports for consumption, by fiscal years.*

## POTASH, CHLORATE OF.

Fiscal years.	Rate of duty.	Quantities.	Values.	Duties collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		<i>Pounds.</i>				
1909.....	2½ cents per pound.....	20,801	\$1,655.00	\$520.00	.....	31.42
1910.....	2 cents per pound.....	418,845	26,603.00	8,277.00	80.064	31.11
1911.....	.....do.....	25,069	2,096.00	501.00	.083	23.92
1912.....	.....do.....	42,131	3,444.00	842.00	.082	24.47
1913.....	.....do.....	1,235,732	66,609.00	24,714.00	.054	37.10
1914.....	.....do.....	7,380	704.00	147.00	.....	20.97
1914.....	½ cent per pound.....	32,939	2,704.00	164.00	.....	6.09
1915.....	.....do.....	27,419	4,614.00	137.00	.....	2.97
1917.....	.....do.....	437,339	194,008.00	2,186.00	.....	1.13
1918.....	.....do.....	1,006,320	357,520.00	5,031.60	.....	1.41

*Exports.*—Exports of potassium chlorate are not shown in Commerce and Navigation prior to 1918 when there was exported 1,564,-662 pounds valued at \$681,128. Australia and British Africa were the chief consuming countries.

## POTASSIUM CHLORIDE (MURIATE OF POTASH).

*Description and uses.*—Potassium chloride, known commercially as muriate of potash, occurs as the mineral sylvite, and also in carnallite, a mixed chloride of potassium and magnesium, in the Stassfurt and other salt deposits of Europe. When pure it is a white crystalline solid readily soluble in water.

The chief use of the crude salt is as a fertilizer. It is also used as the crude material for the preparation of caustic potash and chlorate of potash by the electrolytic process.

*Manufacture.*—Germany manufactures large quantities of potassium chloride from the Stassfurt carnallite. The method of manufacture depends upon the fact that carnallite is decomposed by water which separates crystals of potassium chloride and causes the magnesium chloride to pass into solution. On heating, much more potassium chloride passes into solution, which, on cooling, separates almost entirely free from magnesium chloride. In actual practice the carnallite is dissolved in hot water until saturated, when it is filtered from any insoluble matter and then allowed to cool. On cooling, nearly pure potassium chloride separates, provided the proportion of magnesium chloride in solution does not exceed three times the potassium chloride. The liquor may be used for dissolving fresh portions of carnallite. The potassium chloride may be purified by washing with cold water or by dissolving and recrystallizing.

Some potassium chloride is also obtained from kelp and some from the liquors left from the manufacture of salt from sea water.

*Domestic production.*—Potassium chloride has been produced in this country during the war. In 1918 the production of muriate of potash was 30,127 tons of crude salt, containing 12,614 tons of actual potash ( $K_2O$ ). In addition there was produced 6,559 tons of a low grade chloride of potash, containing 894 tons of actual potash ( $K_2O$ ).

*Imports.*—Prior to 1916 the United States imported most of the potassium chloride it consumed from Germany, the amount in 1914

being 236,218 tons, with a value of \$7,854,895. Since then the total imports have fallen off greatly, the records showing only 606 tons in 1917, mostly from Scotland and Japan, and 596 tons in 1918. There have been no imports from Germany since 1916, when only 8 tons were imported from that country.

*Imports by countries.*

POTASH, MURIATE OF.

[Free.]

Imported from—	1909		1910		1911	
	Tons.	Dollars.	Tons.	Dollars.	Tons.	Dollars.
Germany.....	131,802	4,724,505	174,589	5,635,011	190,354	6,343,719
Netherlands.....	607	22,527	.....	.....	1,464	71,479
Belgium.....	123	4,220	.....	.....	689	34,378
All others.....	202	7,645	145	5,630	.....	.....
Total.....	132,734	4,758,907	174,734	5,640,641	192,507	6,449,576

  

Imported from—	1912		1913		1914	
	Tons.	Dollars.	Tons.	Dollars.	Tons.	Dollars.
Germany.....	215,627	7,225,779	201,200	6,781,181	236,218	7,854,895
Netherlands.....	255	7,568	.....	.....	434	12,858
Belgium.....	75	2,371	20	865	94	3,529
All others.....	.....	.....	.....	10	1,140	44,241
Total.....	215,957	7,235,718	201,220	6,782,056	237,886	7,915,523

  

Imported from—	1915		1916		1917		1918	
	Tons.	Dollars.	Tons.	Dollars.	Tons.	Dollars.	Tons.	Dollars.
Germany.....	90,443	3,112,559	8	800	.....	.....	.....	.....
Netherlands.....	10,163	434,282	.....	.....	.....	.....	.....	.....
Belgium.....	.....	.....	.....	.....	.....	.....	.....	.....
All others.....	2,126	119,277	2,122	460,631	.....	.....	.....	.....
Total.....	102,732	3,666,118	2,130	461,431	606	174,806	723	195,154

*Imports for consumption, by fiscal years.*

POTASH, MURIATE OF.

Fiscal years.	Rate of duty.	Quantities.	Values.	Duties collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
1909.....	Free.....	132,740	\$4,758,906.00	.....	.....	.....
1910.....	do.....	174,935	5,640,541.00	.....	.....	.....
1911.....	do.....	191,324	6,449,575.00	.....	.....	.....
1912.....	do.....	216,101	7,235,728.00	.....	.....	.....
1913.....	do.....	199,854	6,737,757.00	.....	.....	.....
1914.....	do.....	234,855	7,925,781.00	.....	.....	.....
1915.....	do.....	102,882	3,660,353.00	.....	.....	.....
1916.....	do.....	2,126	460,888.00	.....	.....	.....
1917.....	do.....	606	174,806.00	.....	.....	.....
1918.....	do.....	596	156,979.00	.....	.....	.....

## POTASSIUM CHROMATE AND DICHROMATE.

*Description.*—These are both salts of potash and chromic acid and have much the same uses. Both crystallize well, but the dichromate being much less soluble in cold water crystallizes better and is the one usually prepared. The chromate may be converted to the dichromate by treatment with acids and the dichromate to the chromate by treatment with an alkali. Potassium chromate is yellow and potassium dichromate is orange red.

*Uses.*—Potassium dichromate is used to a much greater extent than the chromate of potash, owing to its greater richness in chromic acid and the fact that it is more easily crystallized and purified. It is a strong oxidizing agent. The chief uses of dichromate of potash are in the chrome tanning of leather, textile dyeing and printing, manufacture of chrome pigments and colors, pickling of brass, and the electroengraving of copper plates. It is also used in bleaching oils and fats, for other oxidation purposes, and as a chemical reagent. Wherever possible the cheaper sodium salt is now being used instead of the potassium salt.

*Manufacture.*—Potassium chromate and bichromate are prepared from chrome iron ore or chromite, the larger portion of which is imported. The ore is pulverized and mixed with lime and potassium carbonate. This mixture is then heated to bright redness in a strong current of air. The fused mass is then lixiviated with water forming a solution of calcium and potassium chromates. Additional potash, usually potassium sulphate, is added to the solution to convert the calcium chromate into potassium chromate. The clear solution of potassium chromate is then drawn off and treated with sulphuric acid, thus producing potassium dichromate which is crystallized from the solution.

*Domestic production.*—Figures for the domestic production of chromate and bichromate of potash are not available, but it is known that the consumption is largely supplied by domestic manufacturers.

*Imports.*—The imports since 1910 have not been more than 40,000 pounds and have been entirely negligible since 1915.

*Imports for consumption, by fiscal years:*

## POTASH, CHROMATE AND DICHROMATE OF.

Fiscal years.	Rate of duty.	Quantities.	Values.	Duties collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
<i>Pounds.</i>						
1909.....	3 cents per pound.....	171,541	\$12,330.00	\$5,146.00	.....	41.74
1910.....	2½ cents per pound.....	877,151	43,037.00	19,735.00	\$0.049	45.86
1911.....	do.....	22,880	1,699.00	514.00	.076	30.30
1912.....	do.....	24,094	2,273.00	542.00	.004	23.85
1913.....	do.....	27,671	2,601.00	622.00	.108	23.94
1914.....	1 cent per pound.....	34,860	2,822.00	348.00	.081	12.35
1915.....	do.....	40,277	3,317.00	402.00	.....	12.12
1916.....	do.....	2,291	391.00	22.00	.....	5.86
1917.....	do.....	2,404	962.00	24.00	.....	2.50
1918.....	do.....	20	8.00	.20	.....	2.50

## POTASSIUM CYANIDE.

*Description.*—Potassium cyanide is a white crystalline solid. It is very soluble in water and is extremely poisonous. At present sodium cyanide, because it is much cheaper and contains a larger per cent of cyanide, has practically driven potassium cyanide off the market. Much so-called "potassium cyanide" is actually sodium cyanide.

*Uses.*—Its principal use is for the extraction of gold and silver from their ores. Potassium cyanide is also used extensively for fumigating, especially in the culture of citrus fruits. Other uses are as a solvent for electroplating baths and as a flux in assaying and metallurgy.

*Manufacture.*—Potassium cyanide is made by fusing potassium ferrocyanide with potassium carbonate and carbon and the product purified by dissolving in alcohol.

It may be made from cyanamid by fusing with potassium chloride and carbon when the cyanamid and potassium chloride combine to form the cyanide. The crude product obtained in this way is pure enough for many purposes.

*Domestic production.*—Prior to the war domestic production did not supply the demand, considerable amounts being imported. The war has, to a large extent, cut off the imports, and the demand has been met by an increased production of sodium cyanide instead of potassium cyanide.

*Imports.*—Prior to 1913 the import of potassium cyanide was more than 2,000,000 pounds per year, over 90 per cent of which came from Germany. The imports since have declined to a minimum in 1916 of about 44,000 pounds. In 1917 and 1918 the import was over 100,000 pounds, and came chiefly from Spain and Japan.

*Imports for consumption, by fiscal years.*

## POTASH, CYANIDE OF.

Fiscal years.	Rate of duty.	Quantities.	Values.	Duties collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		<i>Pounds.</i>				
1909.....	12½ per cent.	2,752,983	\$394,354.00	\$43,294.00	\$0.140	12.50
1910.....	do	2,422,667	328,146.00	41,018.00	.135	12.50
1911.....	do	2,323,289	328,972.00	40,871.00	.141	12.50
1912.....	do	2,095,541	312,777.00	39,097.00	.149	12.50
1913.....	do	950,990	137,535.00	17,191.00	.145	12.50
1914.....	do	231,312	35,648.00	4,456.00	.154	12.50
1914.....	Free	1,006,487	147,611.00	.....	.147	.....
1915.....	do	747,627	143,331.00	.....	.....	.....
1916.....	do	43,705	9,311.00	.....	.....	.....
1917.....	do	70,147	49,513.00	.....	.....	.....
1918.....	do	13,455	3,150.00	.....	.....	.....

*Imports by countries.*

## POTASH, CYANIDE.

[Dutiable.]

Imported from—	1912		1913		1914	
	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.
Germany.....	2,291,719	343,749	777,441	117,101	167,830	25,437
England.....	234,979	41,973	231,454	29,495	49,616	7,806
Belgium.....	145,132	21,210				
All other.....	35,049	3,846				
Total.....	2,757,179	410,778	1,008,895	146,596	217,446	33,243

[Free.]

Imported from—	1914		1915		1916	
	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.
Germany.....	460,012	59,360	179,972	28,710	25	35
England.....	130,561	20,470	55,924	9,519	10,080	1,801
Austria-Hungary.....			709,797	104,575		
All other.....	672	126	830,024	20,924	33,600	7,475
Total.....	591,275	79,956	1,775,717	163,728	43,705	9,311

Imported from—	1917		1918	
	Pounds.	Dollars.	Pounds.	Dollars.
Germany.....				
England.....			10,988	2,212
Austria-Hungary.....				
Spain.....			130,770	45,173
Japan.....	72,772	51,675	2,177	664
All other.....	31,807	21,533	290	274
Total.....	101,579	76,208	144,225	48,323

1909-1910 included in all other chemicals. 1911 included in all other salts of potash.

In 1915 there were large imports from Austria, 709,000 pounds, and from Canada 775,000 pounds, with none in 1916 and less than 1,000 pounds in 1914.

1917: Total pounds, 101,579; value, \$76,208.

1918: Total pounds, 13,455; value, \$3,130.

## POTASSIUM FERRICYANIDE (RED PRUSSIATE OF POTASH).

*Description.*—Potassium ferricyanide is known commercially as red prussiate of potash. It crystallizes from water in large red crystals without loss of crystallization. It is poisonous and very soluble in water.

*Uses.*—Being a powerful oxidizer it is used in calico printing. Other uses are in the manufacture of blue-print paper and for the production of pigments, such as Turnbull's blue.

*Manufacture.*—The usual method of manufacture is to treat the ferrocyanide with chlorine. This is preferably done in solution.

*Domestic production.*—Figures for the domestic production are not available but it probably has increased considerably since 1915, as the imports have shown a very great decrease since then.

*Imports.*—In 1914 the imports were 89,976 pounds, nearly all of which came from Germany and Austria-Hungary. In 1915 the imports

were only slightly less but in 1916 dropped to 2,040 pounds. Since then the imports have increased somewhat and in 1918 amounted to 9,924 pounds.

*Imports for consumption, by fiscal years.*

POTASH, PRUSSIATE OF, RED.

Fiscal years.	Rate of duty.	Quantities.	Values.	Duties collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
<i>Pounds.</i>						
1909.....	8 cents per pound.....	77,255	\$13,522.00	\$6,180.00	\$0.175	\$45.71
1910.....	.....do.....	65,777	12,460.00	5,262.00	.189	42.23
1911.....	.....do.....	55,082	10,230.00	4,406.00	.186	43.07
1912.....	.....do.....	71,612	11,264.00	5,728.00	.158	50.86
1913.....	.....do.....	65,316	11,302.00	5,225.00	.173	46.23
1914.....	.....do.....	4,873	835.00	389.00	.172	46.69
1914.....	2 cents per pound.....	85,103	14,490.00	1,702.00	.....	11.75
1915.....	.....do.....	83,574	14,922.00	1,671.00	.....	11.20
1916.....	.....do.....	2,040	3,182.00	40.00	.....	1.28
1917.....	.....do.....	4,523	10,425.00	90.00	.....	.87
1918.....	.....do.....	9,924	18,495.00	198.00	.....	1.07

POTASSIUM FERROCYANIDE (YELLOW PRUSSIATE OF POTASH).

*Description.*—Potassium ferrocyanide, known as yellow prussiate of potash, crystallizes from water in large yellow crystals containing water of crystallization. When heated, or exposed to dry air, the crystals lose their water and become a white powder. Potassium ferrocyanide is readily soluble in water and is not poisonous.

*Uses.*—Potassium ferrocyanide is used for the preparation of Prussian blue, in calico printing, for dyeing silk, for casehardening of iron, and for making potassium cyanide and ferricyanide. Small amounts are used in the manufacture of some explosives and as a reagent in analytical chemistry. Within the last few years sodium ferrocyanide has replaced potassium ferrocyanide for most purposes because it is much cheaper and in many cases is just as efficient.

*Manufacture.*—Formerly the method for manufacturing potassium ferrocyanide was to fuse nitrogenous organic matter with potassium carbonate and iron borings. The organic matter used was hides, hoofs, hair, blood, etc. After fusion, the remaining mass was treated with water near the boiling point for some hours, the solution drawn off, and the ferrocyanide allowed to crystallize.

At present potassium ferrocyanide is produced almost entirely from the spent oxide which is obtained during the purification of coal gas. This is first treated with water to dissolve out ammonia and soluble salts, then dried, the sulphur extracted with carbon bisulphid, and the residue mixed with lime. This is then heated with steam and forms calcium ferrocyanide, and on treating this with potassium chloride a double calcium potassium ferrocyanide is formed. When this is treated with potassium carbonate, calcium carbonate separates and potassium ferrocyanide remains in solution.

*Domestic production.*—Late figures for the production of potassium ferrocyanide are not available. In 1909 the United States produced 3,510,208 pounds and in 1914, 3,204,684, which probably represented a little less than half of the total consumption.

*Imports.*—The imports for 1914 amounted to 3,508,229 pounds, more than 50 per cent of which came from Germany and about 27 per cent from England. In 1915 the imports were 2,315,736 pounds but dropped the next year to 44,156 pounds. In 1918 the imports were 134,638 pounds.

*Imports for consumption, by fiscal years.*

POTASH, PRUSSIATE OF, YELLOW.

Fiscal years.	Rate of duty.	Quantities.	Values.	Duties collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
1909.....	4 cents per pound.....	<i>Pounds.</i> 1,754,377	\$178,744.00	\$70,175.00	\$0.102	\$39.26
1910.....	do.....	2,330,871	229,907.00	93,234.00	.097	40.55
1911.....	do.....	1,777,313	180,584.00	71,092.00	.101	39.37
1912.....	do.....	2,072,761	203,295.00	82,910.00	.098	40.78
1913.....	do.....	2,812,408	309,302.00	112,496.00	.....	36.37
1914.....	do.....	521,244	58,455.00	20,849.00	.....	36.67
1914.....	14 cents per pound.....	2,986,984	331,566.00	37,337.00	.....	11.26
1915.....	do.....	2,316,736	255,711.00	28,959.00	.....	11.32
1916.....	do.....	44,156	31,651.00	551.00	.....	1.74
1917.....	do.....	41,128	32,251.00	514.00	.....	1.50
1918.....	do.....	134,638	111,096.00	1,683.00	.....	1.61

POTASSIUM HYDRATE.

*Description.*—This substance, also known as caustic potash, is a white solid substance. It absorbs water and carbon dioxide readily from the air and is very easily soluble in water, giving a strongly caustic solution.

*Uses.*—It is used in the manufacture of soft soaps; in the preparation of oxalic acid in the manufacture of some dyes, and in preparing caustic lyes and as a chemical reagent. Owing to the great advance in price of potash salts it is being replaced wherever possible by sodium hydroxide.

*Manufacture.*—The usual method of manufacture is by the electrolysis of a solution of potassium chloride.

*Domestic production.*—Data for the production of potassium hydrate in the United States are not available, but previous to the beginning of the war nearly all that was used was imported.

*Imports.*—Since 1913 the imports have declined so that in 1917 the total imports amounted to only 68,095 pounds as compared to 8,896,805 pounds in 1913. Most of the imports before 1916 were from Germany.

## THE POTASH INDUSTRY.

*Imports by countries.*

## POTASH, HYDRATE OF, CONTAINING NOT MORE THAN 15 PER CENT CAUSTIC SODA.

[Free.]

Imported from—	1914		1915		1916	
	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.
Germany.....	5,867,065	219,936	4,444,128	179,599	4,500	700
Belgium.....	63,706	2,246	47,938	1,485	.....	.....
Austria-Hungary.....	291,040	13,285	.....	.....	.....	.....
United Kingdom.....	48,173	3,005	52,272	5,918	.....	.....
All others.....	197,292	10,657	472,953	38,547	39,470	8,732
Total.....	6,467,276	249,129	5,017,291	225,549	43,970	9,432

Imported from—	1917		1918	
	Pounds.	Dollars.	Pounds.	Dollars.
Germany.....	.....	.....	.....	.....
Belgium.....	.....	.....	.....	.....
Austria-Hungary.....	.....	.....	.....	.....
United Kingdom.....	11,355	5,905	.....	.....
All others.....	156,740	24,508	.....	.....
Total.....	68,065	30,413	11,732	4,398

<sup>1</sup> Chiefly from Sweden.

## POTASH, HYDRATE OF, OR CAUSTIC—NOT IN STICKS OR ROLLS.

[Free.]

Imported from—	1909		1910		1911	
	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.
Germany.....	4,611,729	204,720	6,183,411	256,602	5,557,278	244,936
Belgium.....	599,647	21,091	516,594	18,189	778,157	22,314
Austria-Hungary.....	499,012	18,986	606,677	23,184	341,214	12,044
United Kingdom.....	335,937	16,789	708,433	34,259	463,200	22,551
All others.....	986,334	33,143	776,276	25,699	284,297	8,152
Total.....	7,032,659	294,709	8,793,391	357,933	7,424,146	309,997

Imported from—	1912		1913		1914	
	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.
Germany.....	7,024,946	280,895	7,499,356	289,351	1,682,631	66,313
Belgium.....	541,480	17,499	416,232	15,169	5,726	190
Austria-Hungary.....	157,022	6,330	704,754	28,273	260,764	8,899
United Kingdom.....	343,502	16,049	123,278	6,238	33,605	2,083
All others.....	353,102	9,839	153,185	5,370	400	54
Total.....	8,420,052	330,612	8,896,805	344,401	1,983,126	77,539

<sup>1</sup> Figures cover period July 1 to Oct. 3, 1913, inclusive.

*Imports for consumption, by fiscal years.*

## POTASH, HYDRATE OF, OR CAUSTIC, NOT INCLUDING REFINED IN STICKS OR ROLLS.

Fiscal years.	Rate of duty.	Quantities.	Values.	Duties collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
1909.....	Free.....	<i>Pounds.</i> 7,041,657	\$294,709.00	.....	\$0.042	.....
1910.....	.....do.....	8,785,491	358,855.00	.....	.041	.....
1911.....	.....do.....	7,426,402	309,985.00	.....	.042	.....
1912.....	.....do.....	8,422,007	330,684.00	.....	.039	.....
1913.....	.....do.....	8,994,449	348,500.00	.....	.039	.....
1914.....	.....do.....	1,936,328	77,620.00	.....	.039	.....

## POTASH, HYDRATE OF, OR CAUSTIC, REFINED, IN STICKS OR ROLLS.

1909.....	1 cent per pound.....	127,611	\$9,289.00	\$1,276.00	.....	13.74
1910.....	.....do.....	141,430	11,094.00	1,414.00	.....	12.75
1911.....	.....do.....	82,854	9,254.00	828.00	.....	8.95
1912.....	.....do.....	77,184	8,096.00	771.00	.....	9.53
1913.....	{ D. R. U. S.	112,821	11,919.00	1,128.00	.....	9.47
1914.....	1 cent per pound.....	18,751	1,977.00	187.00	.....	9.48

## POTASH, HYDRATE OF, NOT CONTAINING MORE THAN 15 PER CENT CAUSTIC SODA.

1914.....	Free.....	6,579,125	\$249,030.00	.....	.....	.....
1915.....	.....do.....	4,993,471	225,002.00	.....	.....	.....
1916.....	.....do.....	39,770	9,222.00	.....	.....	.....
1917.....	.....do.....	74,780	33,648.00	.....	.....	.....
1918.....	.....do.....	11,732	4,398.00	.....	.....	.....

## POTASSIUM IODIDE AND IODATE.

*Description and uses.*—Potassium iodate is of very little commercial importance. Potassium iodide is an important medicinal and chemical reagent. The sodium iodide is replacing the potassium salt to a great extent because it is much cheaper and for the most purposes it is equally suitable.

*Domestic production.*—Most of the potassium iodide used in the United States is produced by domestic manufacturers from imported raw materials.

*Imports.*—The imports of potassium iodide and iodate were small and practically negligible prior to the war. Since 1916 the import has increased until in 1918 there was imported 65,992 pounds. Japan has exported considerable quantities of potassium iodide during the war and it is likely that these imports were from that country.

*Imports for consumption, by fiscal years.*

## POTASH, HYDRIODATE, IODIDE, AND IODATE OF.

Fiscal years.	Rate of duty.	Quantities.	Values.	Duties collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		<i>Pounds.</i>				
1909.....	25 cents per pound.....	242	\$489.00	\$60.00	.....	12.35
1910.....	do.....	142	275.00	35.00	.....	12.91
1911.....	do.....	272	519.00	68.00	.....	13.10
1912.....	do.....	238	451.00	59.00	.....	13.19
1913.....	do.....	120	239.00	30.00	.....	12.55

## POTASSIUM IODIDE.

1914.....	15 cents per pound.....	162	\$491.00	\$24.34	\$3.03	\$4.96
1915.....	do.....	4	13.00	.60	.....	4.62
1916.....	do.....	309	1,032.00	46.35	.....	4.49
1917.....	do.....	24,357	58,752.00	3,653.55	.....	6.22
1918.....	do.....	65,942	135,611.00	9,098.80	.....	.....

## POTASSIUM NITRATE.

*Description.*—Potassium nitrate, or saltpeter, is the potassium salt of nitric acid. It is a white crystalline substance which is easily soluble in water.

*Uses.*—Potassium nitrate is one of the ingredients of ordinary gunpowder and of some other explosives and fireworks. It is also used in curing meats and as a reagent in assaying.

*Manufacture.*—Formerly potassium nitrate was obtained almost entirely from niter earths, which occur mostly in India. Now much of it is produced by the double decomposition of sodium nitrate and potassium chloride. Before the war large quantities were made in this way in Germany from the potassium chloride of Stassfurt and sodium nitrate imported from Chile.

*Domestic production.*—There are no deposits of potassium nitrate in the United States. In 1914 there was produced from imported raw materials 29,480,000 pounds of potassium nitrate, valued at \$1,244,051.

*Imports.*—The imports of crude nitrate in 1914 were 3,546,580 pounds, valued at \$115,344. In 1915 the imports amounted to only 677,785 pounds, but increased greatly the next three years, amounting to 10,171,654 pounds in 1917 and 8,815,327 pounds in 1918.

Prior to 1914 most of the imports were from Germany and British India, but with the beginning of the war the German imports ceased and those from India fell off greatly. In 1916 and 1917 the largest imports were from the United Kingdom, with South America ranking second.

THE POTASH INDUSTRY.

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*Imports for consumption, by fiscal years.*  
POTASH, NITRATE OF (CR SALT PETER), CRUDE.

Fiscal years.	Rate of duty.	Quantities.	Values.	Duties collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
1909.....	Free.....	<i>Pounds.</i> 17,470,648	\$512,473.00	.....	\$0.029	.....
1910.....	do.....	25,144,975	675,765.00	.....	.027	.....
1911.....	do.....	9,288,557	282,835.00	.....	.03	.....
1912.....	do.....	6,172,441	213,258.00	.....	.035	.....
1913.....	do.....	10,989,382	288,995.00	.....	.026	.....
1914.....	do.....	3,547,252	115,470.00	.....	.033	.....
1915.....	do.....	677,785	22,483.00	.....	.....	.....
1916.....	do.....	5,412,130	734,123.00	.....	.....	.....
1917.....	do.....	10,171,654	904,506.00	.....	.....	.....
1918.....	do.....	8,815,327	956,853.00	.....	.....	.....

POTASH, NITRATE OF (OR SALTPETER), REFINED.

		Tons.				
1909.....	\$11.20 per ton.....	185	\$14,421.00	\$2,076.00	\$77.95	\$14.40
1910.....	do.....	1,165	115,457.00	13,054.00	99.00	11.30
1911.....	do.....	380	38,334.00	4,258.00	101.00	11.09
1912.....	do.....	19	23,896.00	2,214.00	120.68	9.27
1913.....	do.....	176	22,142.00	1,968.00	125.80	8.89
1914.....	do.....	34	4,306.00	385.00	126.65	8.94
1914.....	\$7 per ton.....	128.5	15,867.00	899.00	123.48	5.67
1915.....	do.....	54	4,222.00	238.00	.....	5.64
1916.....	do.....	2	749.00	14.00	.....	1.87
1917.....	do.....	288	35,143.00	2,016.00	.....	5.74
1918.....	do.....	43	16,193.00	301.00	.....	1.88

*Imports by countries.*

POTASH, NITRATE OF, OR SALTPETER, CRUDE.

Imported from—	1909		1910		1911	
	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.
Germany.....	510	29	450,556	7,741	132,710	2,195
British India.....	17,400,555	510,357	11,306,332	339,690	9,144,837	280,354
United Kingdom.....	66,231	2,007	.....	.....	.....	.....
Canada.....	1,360	40	.....	.....	.....	.....
All others.....	2,000	40	366	9	.....	.....
Total.....	17,470,656	512,473	11,757,254	347,440	9,277,547	282,549

Imported from—	1912		1913		1914	
	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.
Germany.....	804,323	13,593	4,964,700	90,593	112,717	2,167
British India.....	6,171,431	213,258	6,166,352	207,358	3,433,863	113,177
United Kingdom.....	.....	.....	2,240	30	.....	.....
Canada.....	.....	.....	23,178	1,014	.....	.....
All others.....	.....	.....	157,456	1,497	.....	.....
Total.....	6,975,754	226,851	11,213,926	290,492	3,546,580	115,344

Imported from—	1915		1916		1917		1918	
	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.
British India.....	670,930	22,083	1,106,770	152,705	456,000	82,300	257,600	34,500
United Kingdom.....	.....	.....	4,282,960	577,055	5,102,643	736,594	6,915,332	747,696
Canada.....	.....	.....	120,413	27,695	.....	.....	.....	.....
Chile.....	.....	.....	.....	.....	3,407,520	77,720	32,080	1,432
All other.....	16,855	400	22,400	4,363	1,145,491	7,892	1,615,355	171,390
Total.....	677,785	22,483	5,532,545	761,818	10,171,654	904,506	8,820,367	955,018

<sup>1</sup> Chiefly Russia.

<sup>2</sup> Cuba.

<sup>3</sup> Japan.

## POTASSIUM PERMANGANATE.

*Description.*—Potassium permanganate forms purplish black crystals with a greenish metallic luster which dissolve in water, giving a deep purple red solution. It is a powerful oxidizer, and when mixed with organic matter may cause spontaneous combustion.

*Uses.*—It is used largely as an oxidizer. It is used for bleaching, in dyeing shoe leather and for coloring wood a deep brown, for purifying ammonia and carbon dioxide, etc. It is used to some extent in medicine, especially as a local disinfectant and germicide. It is an important reagent in analytical chemistry. It is estimated that over 50 per cent of the domestic production of potassium permanganate during the war was used in the manufacture of saccharin.

*Manufacture.*—The usual method of manufacture is to mix a solution of potassium hydroxide with powdered manganese ore and potassium chlorate or potassium nitrate, evaporate to dryness, and fuse the residue until it becomes pasty. This forms potassium manganate, which is then dissolved in water and treated with sulphuric acid, chlorine, or carbon dioxide. On evaporation the permanganate crystallizes.

Another method which is used in this country is to fuse manganese ore with caustic soda, producing sodium manganate. This is oxidized electrolytically to sodium permanganate and caustic soda. This solution is then treated with carbon dioxide, forming soda ash, which crystallizes on evaporation, leaving the sodium permanganate in solution. The sodium permanganate is now treated with a potassium salt, preferably the carbonate, which produces the potassium permanganate. This is separated by crystallization. Sodium permanganate crystallizes very poorly.

*Domestic production.*—Prior to the war there was no production of permanganate of potash in this country. The shutting off of imports, the demands for war purposes, and the large demand for the manufacture of saccharin has greatly stimulated the industry in the United States. Several firms manufactured permanganate of potash in this country during the war. It is estimated that the consumption of permanganate of potash in the United States is approximately 5,000,000 pounds per year.

*Imports.*—In 1914 the imports of potassium permanganate were 1,351,855 pounds, nearly all of which came from Germany, but by 1916 they had fallen to 208,979 pounds, and in 1917 to 5,695 pounds. In 1918 the imports were 43,826 pounds. Some was imported from Japan, but when the prices fell these imports were reduced, as Japan was not able to import into this country at the lower prices..

*Imports for consumption, by fiscal years.*

## POTASH, PERMANGANATE OF.

Fiscal years.	Rate of duty.	Quantities.	Values.	Duties collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		<i>Pounds.</i>				
1909.....	25 per cent.....	592,805	\$10,572.00	\$10,143.00	\$0.068	\$25.00
1910.....	.....do.....	565,215	38,479.00	9,619.00	.067	25.00
1910.....					.069	
1911.....	25 per cent.....	638,159	44,135.00	11,033.00	.069	25.00
1912.....	.....do.....	432,937	29,932.00	7,483.00	.069	25.00
1913.....	.....do.....	357,366	25,314.00	6,328.00	.071	25.00
1914.....	.....do.....	75,260	5,269.00	1,317.00	.070	25.00
1914.....	1 cent per pound.....	1,276,595	85,796.00	12,765.00	.067	14.88
1915.....	.....do.....	1,039,304	78,924.00	10,393.00	.076	13.17
1916.....	.....do.....	209,979	56,146.00	2,089.00	.269	3.72
1917.....	.....do.....	5,695	9,391.00	50.00	1.65	.64
1918.....	.....do.....	43,826	106,104.00	438.26	2.42	.41

## POTASSIUM SULPHATE.

*Description and uses.*—Potassium sulphate in the pure state forms well-defined crystals which are soluble in water and have a bitter taste. It is used principally in the crude form as a fertilizer. It is also used for the production of potassium carbonate by the Leblanc process and in the manufacture of potash alum. Some is used by glass works.

*Manufacture.*—Large quantities of potassium sulphate are manufactured in Germany from kainite near Stassfurt. Kainite, which is a double sulphate of potassium and magnesium containing potassium chloride, is dissolved in water, and on concentrating this solution the sulphates of potassium and magnesium separate, which, when concentrated with potassium chloride, form potassium sulphate and magnesium chloride. The potassium sulphate, being the less soluble, crystallizes on evaporating the solution.

Potassium sulphate may also be made by treating potassium chloride with sulphuric acid. In this way hydrochloric acid is also produced.

*Domestic production.*—In 1918 the domestic production of sulphate of potash was 6,672 tons of crude salts containing 3,188 tons of actual potash ( $K_2O$ ).

*Imports*—Prior to the war all of that consumed in this country was imported from Germany, but there have been no imports from there since 1915. The total imports in 1914 were 45,139 tons, but had dropped to 661 tons in 1917, the greater part of which came from Japan. In 1918 only 136 tons were imported.

## THE POTASH INDUSTRY.

*Imports for consumption, by fiscal years.*

## POTASH, SULPHATE OF, CRUDE OR REFINED.

Fiscal years.	Rate of duty.	Quantities.	Values.	Duties collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		<i>Tons.</i>				
1909.....	Free.....	27,239	\$1,148,607.00			
1910.....	do.....	37,933	1,399,915.00			
1911.....	do.....	47,442	1,952,370.00			
1912.....	do.....	45,135	1,853,235.00			
1913.....	do.....	42,877	1,798,369.00			
1914.....	do.....	7,596	315,029.00			
1914.....	do.....	37,389	1,572,462.00			
1915.....	do.....	21,705	1,071,623.00			
1916.....	do.....	2,427	197,908.00			
1917.....	do.....	656	20,538.00			
1918.....	do.....	136	19,837.00			

*Imports by countries.*

## POTASH, SULPHATE OF.

[Free.]

Imported from—	1909		1910		1911	
	Tons.	Dollars.	Tons.	Dollars.	Tons.	Dollars.
Germany.....	26,923	1,132,396	37,087	1,392,902	46,960	1,927,504
Netherlands.....			88	4,082	100	3,076
United Kingdom.....	25	1,190	135	7,255	300	17,787
Belgium.....	206	10,309			31	1,710
All others.....	136	4,711	270	7,995	50	2,291
Total.....	27,290	1,148,606	38,480	1,412,234	47,441	1,952,368

  

Imported from—	1912		1913		1914	
	Tons.	Dollars.	Tons.	Dollars.	Tons.	Dollars.
Germany.....	43,881	1,802,731	42,696	1,751,661	43,993	1,827,763
Netherlands.....	508	18,630			221	11,683
United Kingdom.....	62	4,093			915	57,827
Belgium.....	25	1,382	49	1,824	10	467
All others.....						
Total.....	44,476	1,826,836	42,745	1,753,485	45,139	1,897,740

  

Imported from—	1915		1916		1917		1918	
	Tons.	Dollars.	Tons.	Dollars.	Tons.	Dollars.	Tons.	Dollars.
Germany.....	18,973	842,134						
Netherlands.....	1,274	70,403						
United Kingdom.....	54	3,126						
Belgium.....	206	9,710	2,423	197,808	661	20,538		
All others.....	1,345	146,388						
Total.....	21,852	1,071,761	2,423	197,808	661	20,538	135	19,837

**KELP.**

*Description.*—The name kelp was originally applied to the ash obtained by burning seaweed. This was recovered for its soda and iodine content. The name has now been extended, especially in the United States, to apply to the weeds themselves, especially those which may be made to yield potash, iodine, and other valuable products.

*Uses.*—Kelp is used principally for the production of potash salts and iodine, though other valuable products may be obtained. Some of these are acetic acid, butyric acid, propionic acid, and acetone. It is reported that a process has been devised for obtaining alcohol in large quantities from kelp. Dried and ground kelp is sometimes used directly as a fertilizer.

*Domestic production.*—Very little kelp was utilized in this country before 1914, but the shortage of potash salts, due to the war in Europe, caused the large quantities of seaweed along the Pacific coast to be made use of. A number of plants started up for the manufacture of potash and other products from kelp and at least one of them had a capacity of close to 1,000 tons of fresh kelp per day.

Many of these plants have already shut down and the remainder probably will be compelled to if the price of potash goes down to anywhere near what it was before the war.

*Imports.*—Some kelp has been imported but the imports have been very small and irregular.

**KAINITE.**

*Description.*—Kainite is a natural product which occurs in the large salt deposits of Europe. It is a complex salt consisting of the sulphate of potash and the sulphate and chloride of magnesia. It contains water of crystallization. The commercial kainite contains at most only about 70 per cent of the mineral. When heated with water under pressure, it decomposes into a double sulphate of potassium and magnesium, potassium chloride, and magnesium chloride.

*Uses.*—Kainite is used in the crude state, without any treatment except grinding, as a fertilizer. Some of it is also used for the production of potassium sulphate.

*Domestic production.*—The United States produces no kainite, all that is used being imported.

*Imports.*—There have been no imports since 1916. All the kainite imported came from Germany. In 1914 the United States imported 541,846 tons. The imports have since decreased until in 1916 only 64 tons were imported. In 1917 and 1918 there were no imports.

*Imports for consumption, by fiscal years.  
KAINITE.<sup>1</sup>*

Fiscal years.	Rate of duty.	Quantities.	Values.	Duties collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Tons.				
1909.....	Free.....	314,525	\$1,974,165.00	.....	.....	.....
1910.....	do.....	470,241	2,268,363.00	.....	.....	.....
1911.....	do.....	586,474	2,637,105.00	.....	.....	.....
1912.....	do.....	479,817	2,400,589.00	.....	.....	.....
1913.....	do.....	466,184	2,149,689.00	.....	.....	.....
1914.....	do.....	526,112	2,579,619.00	.....	.....	.....
1915.....	do.....	78,124	444,996.00	.....	.....	.....
1916.....	do.....	64	1,795.00	.....	.....	.....
1917.....	do.....					
1918.....	do.....					

<sup>1</sup> Entered in 1909 as "Kieserite," kyanite, or cyanite, and kainite.

*Imports by countries.  
KAINITE.<sup>1</sup>*

[Free.]

Imported from—	1912		1913		1914	
	Tons.	Dollars.	Tons.	Dollars.	Tons.	Dollars.
Germany.....	484,882	2,398,848	466,795	2,154,977	536,904	2,554,567
Netherlands.....	250	913	.....	.....	4,932	24,977
Belgium.....	.....	.....	.....	.....	10	75
Total.....	485,132	2,399,761	466,795	2,154,977	541,846	2,579,619

  

Imported from—	1915		1916		1917	
	Tons.	Dollars.	Tons.	Dollars.	Tons.	Dollars.
Germany.....	74,811	372,294	.....	.....	.....	.....
Netherlands.....	1,333	9,201	.....	.....	.....	.....
France.....	2,860	63,265	.....	.....	.....	.....
Cuba.....	.....	6	.....	300	.....	.....
Peru.....	.....	58	.....	1,495	.....	.....
Total.....	79,004	444,760	64	1,795	.....	.....

<sup>1</sup> Included in "All other fertilizers" in 1909 and 1910 and in "Manure salts and kainite" in 1911. There was no import in 1917 and 1918.

*Foreign production.*—The salt mines near Stassfurt, Germany, furnished nearly all the kainite consumed. These mines are controlled by a syndicate which fixes the output of each mine and the price of the products.

During the calendar year of 1913 there were sold by the German Potash Syndicate in the United States 445,706 tons of kainite, most of which went to five large fertilizer companies. Nineteen hundred and thirteen was the last calendar year during which the exports to the United States were normal.

**HARDSALT OR "HARTSALZ."**

*Description and uses.*—Hardsalt is the name given to one of the natural products obtained from the Stassfurt salt deposits. It is a mixture of about 20 per cent sylvine, 25 per cent kieserite, and 55

per cent rock salt. Hardsalt is used principally in the crude state as a fertilizer.

*Imports.*—All that is used in this country is imported from Germany. The amount used by the seven largest fertilizer companies in 1913 was 9,291 tons.

#### MANURE SALT.

*Description.*—Manure salt is a name applied to a mixture of various crude salts which is used chiefly as a fertilizer. Manure salt is of rather indefinite composition, but contains potassium chloride and is sold according to the per cent of K<sub>2</sub>O.

*Manufacture.*—It is produced by a partial purification of natural products and is essentially a mixture of potassium chloride, magnesium sulphate, and sodium chloride.

Manure salt is sold in two grades, the "single manure salt," sold on a basis of 20 per cent K<sub>2</sub>O, and the "double manure salt," sold on a basis of 48 per cent K<sub>2</sub>O.

*Imports.*—Imports of manure salts in 1913 amounted to 223,687 tons,<sup>1</sup> valued at \$2,245,509, but have fallen off rapidly since then, so that in 1918 the imports were only 225 tons, valued at \$9,047.

#### Imports by countries.

##### MANURE SALTS.<sup>2</sup>

[Free.]

Imported from—	1911 <sup>3</sup>		1912		1913	
	Tons.	Dollars.	Tons.	Dollars.	Tons.	Dollars.
Germany.....	738,947	3,888,164	191,242	1,788,783	168,843	1,755,007
Netherlands.....			374	2,300	1,300	11,982
United Kingdom.....	1,308	10,824			11	811
All others.....	137	3,316	1,122	22,988	1,648	26,258
Total.....	740,392	3,902,304	192,738	1,814,071	171,802	1,794,058
Imported from—	1914		1915		1916	
	Tons.	Dollars.	Tons.	Dollars.	Tons.	Dollars.
Germany.....	256,703	2,696,671	60,285	650,749	.....	.....
Netherlands.....	2,247	19,805	2,442	40,636	.....	.....
United Kingdom.....	1,875	36,715	2,736	49,701	2,270	41,785
All others.....	517	14,050	599	19,613	1	40
Total.....	261,342	2,767,241	66,062	760,699	2,271	41,825
Imported from—	1917		1918			
	Tons.	Dollars.	Tons.	Dollars.		
Germany.....					.....	.....
Netherlands.....					.....	.....
United Kingdom.....	324	7,794	190	8,872	.....	.....
All others.....					.....	.....
Total.....	324	7,794	190	8,872	.....	.....

<sup>1</sup> Figures from Mineral Resources, 1917.

<sup>2</sup> Included in "All other fertilizers" in 1910.

<sup>3</sup> "Manure salts and kainit."

## THE POTASH INDUSTRY.

*Imports for consumption, by fiscal years.*

## MANURE SALTS (INCLUDING DOUBLE MANURE SALTS).

[N. s. p. f.]

Fiscal years.	Rate of duty.	Quantities.	Values.	Duties collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		<i>Pounds.</i>				
1910.....	Free.....	90,933	\$928,357.00	.....	.....	.....
1911.....	.....do.....	160,105	1,265,867.00	.....	.....	.....
1912.....	.....do.....	185,682	1,828,126.00	.....	.....	.....
1913.....	.....do.....	172,556	1,794,773.00	.....	.....	.....
1914.....	.....do.....	260,976	2,757,013.00	.....	.....	.....
1915.....	.....do.....	66,411	757,151.00	.....	.....	.....
1916.....	.....do.....	2,278	42,388.00	.....	.....	.....
1917.....	.....do.....	324	7,794.00	.....	.....	.....
1918.....	.....do.....	225	9,047.00	.....	.....	.....

## ALL OTHER POTASH SALTS.

*Imports by countries.*POTASH, ALL OTHER SALTS OF:<sup>1</sup>

[Dutiable.]

Imported from—	1911		1912		1913	
	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.
Germany.....	4,271,328	460,888	2,000,591	188,250	2,464,585	259,247
United Kingdom.....	772,139	67,345	762,353	50,252	1,987,190	121,831
France.....	45,396	4,182	311,018	27,857	411,158	42,091
Netherlands.....	.....	.....	.....	.....	110,588	10,806
All others.....	501,785	54,153	335,541	29,880	308,633	29,915
Total.....	5,650,638	586,573	3,409,503	296,239	5,292,144	463,890

Imported from—	1914		1915		1916	
	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.
Germany.....	2,932,304	258,464	2,765,858	266,931	143,188	11,465
England.....	1,924,311	179,532	465,531	42,310	120	14
France.....	435,671	48,340	11,533	1,260	11,210	17,703
Netherlands.....	167,649	19,001	584,909	55,195	441	47
All others.....	315,653	32,255	217,443	29,893	125,294	77,659
Total.....	5,775,588	537,592	4,045,274	395,589	280,289	106,888

Imported from—	1917		1918	
	Pounds.	Dollars.	Pounds.	Dollars.
Germany.....	.....	.....	.....	.....
England.....	662	242	14,000	4,452
France.....	4,408	5,510	.....	.....
Chile.....	500,000	18,751	.....	.....
Japan.....	519,770	252,874	1,624,548	782,214
All others.....	11,738	11,598	23,605	16,961
Total.....	1,096,578	289,975	1,602,153	803,627

<sup>1</sup> Included in all other chemicals in 1909, 1910.

## WHOLESALE PRICES OF POTASH.

[Data from Oil, Paint, and Drug Reporter.]

## ALUM, CHROME POTASH.

[Per pound, New York, spot.]

Dec. 31, 1917.....	\$0.22 <sup>4</sup> to \$0.23 <sup>4</sup>	October, 1918.....	\$0.20 <sup>4</sup> to \$0.21
Apr. 1, 1918.....	.20 to .22	January, 1919.....	.20 <sup>4</sup> to .21
July 1, 1918.....	.20 to .21	April, 1919.....	.20 <sup>4</sup> to .21

## ALUM, POTASH, LUMP.

[Per pound, New York, spot.]

Jan. 2, 1912 <sup>1</sup> .....	per cwt.. \$1.75 to \$2.00	Sept. 27, 1915 <sup>1</sup> .....	per lb.. \$0.03 <sup>4</sup> to \$0.05
Apr. 1, 1912 <sup>1</sup> .....	do.... 1.75 to 2.00	Jan. 3, 1916 <sup>1</sup> .....	do.... .04 to .05
July 1, 1912 <sup>1</sup> .....	do.... 1.75 to 2.00	Apr. 3, 1916 <sup>1</sup> .....	do.... .04 <sup>4</sup> to .04 <sup>4</sup>
Sept. 20, 1912 <sup>1</sup> .....	do.... 1.75 to 2.00	July 3, 1916 <sup>1</sup> .....	do.... .04 to .04 <sup>4</sup>
Dec. 30, 1912 <sup>1</sup> .....	do.... 1.75 to 2.00	Oct. 2, 1916 <sup>1</sup> .....	do.... .04 to .04 <sup>4</sup>
Mar. 31, 1913 <sup>1</sup> .....	do.... 1.75 to 2.00	Jan. 1, 1917 <sup>1</sup> .....	do.... .04 to .04 <sup>4</sup>
June 30, 1913 <sup>1</sup> .....	do.... 1.75 to 2.00	Apr. 2, 1917.....	do.... .04 to .04 <sup>4</sup>
Sept. 28, 1913 <sup>1</sup> .....	do.... 1.75 to 2.00	July 2, 1917.....	do.... .04 <sup>4</sup> to .05
Dec. 29, 1913 <sup>1</sup> .....	do.... 1.75 to 2.00	Oct. 1, 1917 <sup>1</sup> .....	do.... .04 <sup>4</sup> to .05
Mar. 30, 1914 <sup>1</sup> .....	do.... 1.75 to 2.00	Dec. 31, 1917.....	do.... .08 to .08 <sup>4</sup>
June 29, 1914 <sup>1</sup> .....	do.... 1.75 to 2.00	Apr. 1, 1918.....	do.... .08 to .09 <sup>4</sup>
Sept. 28, 1914 <sup>1</sup> .....	per lb.. 0.02 <sup>4</sup> to 0.03	July 1, 1918.....	do.... .08 to .09 <sup>4</sup>
Dec. 28, 1914 <sup>1</sup> .....	do.... .02 <sup>4</sup> to .02 <sup>4</sup>	October, 1918.....	do.... .11 <sup>4</sup> to .12
Mar. 29, 1915 <sup>1</sup> .....	do.... .02 <sup>4</sup> to .02 <sup>4</sup>	January, 1919.....	do.... .11 <sup>4</sup> to .12
June 28, 1915 <sup>1</sup> .....	per cwt.. 2.40 to 2.50	April, 1919.....	do.... .11 to .12

## POTASH, ACETATE.

[Per pound, New York, spot.]

June 28, 1915.....	\$0.33 to \$0.34	July 2, 1917.....	\$1.25 to \$1.26
Sept. 27, 1915.....	.40 to .42	Oct. 1, 1917.....	1.30 to 1.32
Jan. 3, 1916.....	.50 to .51	Dec. 31, 1917.....	1.50
Apr. 3, 1916.....	1.45 to 1.46	April, 1918.....	1.50
July 3, 1916.....	1.45 to 1.46	July, 1918.....	1.50
Oct. 2, 1916.....	1.25 to 1.26	October, 1918.....	1.50
Jan. 1, 1917.....	1.25 to 1.26	January, 1919.....	1.10 to 1.15
Apr. 2, 1917.....	1.25 to 1.26	April, 1919.....	.95 to 1.00

## POTASH, BICARBONATE.

[Per pound, New York, spot.]

June 28, 1915.....	\$0.30 to \$0.32	July 2, 1917.....	\$1.30 to \$1.40
Sept. 27, 1915.....	.37 to .40	Oct. 1, 1917.....	1.25 to 1.30
Jan. 3, 1916.....	.45 to .50	Dec. 31, 1917.....	1.25 to 1.50
Apr. 3, 1916.....	1.40	April, 1918.....	1.25 to 1.50
July 3, 1916.....	1.65	July, 1918.....	1.25 to 1.50
Oct. 2, 1916.....	1.25 to 1.35	October, 1918.....	.70 to .75
Jan. 1, 1917.....	1.40 to 1.50	January, 1919.....	.65 to .70
Apr. 2, 1917.....	1.30 to 1.40	April, 1919.....	.65 to .70

## BICHROMATE OF POTASH.

[Per pound, New York, spot.]

Jan. 1, 1912.....	\$0.07 <sup>4</sup> to \$0.07 <sup>4</sup>	Sept. 27, 1915.....	\$0.20 to \$0.21
Apr. 1, 1912.....	.07 <sup>4</sup> to .07 <sup>4</sup>	Jan. 3, 1916.....	.45
July 1, 1912 <sup>1</sup> .....	.07 <sup>4</sup> to .07 <sup>4</sup>	Apr. 4, 1916.....	.75
Sept. 30, 1912.....	.06 <sup>4</sup> to .07	July 3, 1916.....	.43 to .45
Dec. 30, 1912.....	.06 <sup>4</sup> to .07	Oct. 2, 1916.....	.33 to .50
Mar. 31, 1913.....	.06 <sup>4</sup> to .07	Jan. 1, 1917.....	.42 to .43
June 30, 1913.....	.06 <sup>4</sup> to .07	July 2, 1917.....	.36 to .37
Sept. 29, 1913.....	.06 <sup>4</sup> to .07	Oct. 1, 1917.....	.45 to .50
Dec. 29, 1913.....	.06 <sup>4</sup> to .07	Dec. 31, 1917.....	.43 <sup>4</sup> to .44
Mar. 28, 1914.....	.06 <sup>4</sup> to .07	April, 1918.....	.43 <sup>4</sup> to .45
June 29, 1914.....	.06 <sup>4</sup> to .07	July, 1918.....	.45 to .46
Sept. 28, 1914.....	.15	October, 1918.....	.42 to .45
Dec. 28, 1914.....	.12 to .13	January, 1919.....	.38 to .41
Mar. 29, 1915.....	.15 <sup>4</sup> to .16	April, 1919.....	.35 to .38
June 28, 1915.....	.21		

## POTASH, CAUSTIC (70 TO 75 PER CENT).

Jan. 2, 1912 <sup>2</sup> .....	per cwt.. \$3.75 to \$4.80	Dec. 28, 1914 <sup>2</sup> .....	per pound.. \$0.07 to \$0.08
Apr. 1, 1912 <sup>2</sup> .....	do.... 3.75 to 4.75	Mar. 29, 1915 <sup>2</sup> .....	do.... .22 to .25
July 1, 1912 <sup>2</sup> .....	do.... 3.75 to 4.75	June 28, 1915 <sup>2</sup> .....	do.... .38 to .40
Sept. 30, 1912 <sup>2</sup> .....	do.... 3.75 to 4.75	Dec. 31, 1917.....	do.... .63 to .64
Dec. 30, 1912 <sup>2</sup> .....	do.... 3.75 to 4.75	Apr. 8, 1918.....	do.... .63 <sup>4</sup> to .65
Mar. 31, 1913 <sup>2</sup> .....	do.... 3.75 to 4.75	July 1, 1918.....	do.... .61 to .62
June 30, 1913 <sup>2</sup> .....	do.... 3.00 to 4.75	October, 1918.....	do.... .60 to .62
Sept. 29, 1913 <sup>2</sup> .....	do.... 3.00 to 4.75	January, 1919.....	do.... .35 to .60
Sept. 28, 1914 <sup>2</sup> .....	per pound.. .17 <sup>4</sup> to .20	April, 1919.....	do.... .42 to .44

<sup>1</sup> Alum, lump.<sup>2</sup> Per cent not stated.

## THE POTASH INDUSTRY.

## WHOLESALE PRICES OF POTASH—Continued.

## POTASH, CAUSTIC (88 TO 92 PER CENT.)

[Per hundredweight, New York, spot.]

Jan. 2, 1912 <sup>1</sup>	\$3.75 to \$4.80	Sept. 27, 1915.....per pound..	\$0.39 to \$0.41
Apr. 1, 1912 <sup>1</sup>	3.75 to 4.75	do.....do.....	.65 to .70
July 1, 1912 <sup>1</sup>	3.75 to 4.75	Apr. 3, 1916.....do.....	.95 to 1.00
Sept. 30, 1912 <sup>1</sup>	3.75 to 4.75	July 3, 1916.....do.....	.83 to .90
Dec. 30, 1912 <sup>1</sup>	3.75 to 4.75	Oct. 2, 1916.....do.....	.85 to .90
Mar. 31, 1913 <sup>1</sup>	3.75 to 4.75	Jan. 1, 1917.....do.....	.90 to .95
June 30, 1913 <sup>1</sup>	3.00 to 4.75	Apr. 2, 1917.....do.....	.88 to .90
Sept. 29, 1913 <sup>4</sup>	3.00 to 4.755	July 2, 1917.....do.....	.84 to .86
Dec. 29, 1913 <sup>2</sup> .....per pound..	.04 to 0.44	Oct. 1, 1917.....do.....	.85 to .90
Mar. 30, 1914 <sup>2</sup> .....do.....	.04 to 0.44	Dec. 31, 1917.....do.....	.83 to .84
June 29, 1914 <sup>2</sup> .....do.....	.0453 to .0465	Apr. 8, 1918.....do.....	.834 to .85
Sept. 28, 1914 <sup>1</sup> .....do.....	.174 to .20	July 1, 1918.....do.....	.80 to .81
Dec. 28, 1914 <sup>1</sup> .....do.....	.07 to .08	October, 1918.....do.....	.70 to .72
Mar. 29, 1915 <sup>1</sup> .....do.....	.22 to .25	January, 1919.....do.....	.67 to .70
June 28, 1915 <sup>1</sup> .....do.....	.38 to .40	April, 1919.....do.....	.50 to .52

## POTASH, CITRATE.

[Per pound, New York, spot.]

Sept. 28, 1914.....	\$0.69 to \$0.70	Apr. 2, 1917.....	\$1.54 to \$1.56
Dec. 28, 1914.....	.69 to .70	July 2, 1917 <sup>2</sup> .....	1.54 to 1.56
Mar. 29, 1915.....	.69 to .70	Oct. 1, 1917 <sup>1</sup> .....	1.54 to 1.58
June 28, 1915.....	.69 to .70	Dec. 31, 1917 <sup>1</sup> .....	1.60
Sept. 27, 1915.....	.73 to .75	April, 1918.....	1.60
Jan. 3, 1916 <sup>1</sup> .....	.73 to .75	July, 1918.....	1.60
Apr. 3, 1916 <sup>2</sup> .....	1.70 to 1.72	October, 1918.....	1.70
July 3, 1916 <sup>2</sup> .....	1.70 to 1.72	January, 1919.....	1.78
Oct. 2, 1916 <sup>2</sup> .....	1.50	April, 1919.....	2.02
Jan. 1, 1917 <sup>2</sup> .....	1.50		

## POTASH, CYANIDE, BULK.

[Per pound, New York, spot.]

Jan. 1, 1912.....	\$0.20 to \$0.24	Sept. 27, 1915.....	\$0.25 to \$0.29
Apr. 1, 1912.....	.20 to .21	Jan. 3, 1916.....	Not listed
July 1, 1912.....	.20 to .24	Apr. 3, 1916 <sup>2</sup> .....	.37 to .38
Sept. 30, 1912.....	.19 to .21	July 3, 1916 <sup>2</sup> .....	.37 to .38
Dec. 30, 1912.....	.19 to .24	Oct. 2, 1916.....	1.00 to 1.20
Mar. 31, 1913.....	.19 to .24	Jan. 1, 1917 <sup>1</sup> .....	2.25 to 2.30
June 30, 1913.....	.19 to .24	Apr. 2, 1917.....	2.00 to 2.10
Sept. 29, 1913.....	.19 to .24	July 2, 1917.....	2.25 to 2.30
Dec. 29, 1913.....	.19 to .22	Oct. 1, 1917.....	2.25 to 2.50
Mar. 28, 1914 <sup>1</sup> .....	.19 to .22	Dec. 31, 1917.....	.60 to .70
June 29, 1914 <sup>1</sup> .....	.19 to .22	April, 1918.....	.60 to .70
Sept. 28, 1914.....	.22 to .23	July, 1918.....	.60 to .70
Dec. 29, 1914.....	.25 to .26	October, 1918.....	.60 to .70
Mar. 29, 1915.....	.18 to .25	January, 1919.....	.60 to .70
June 28, 1915 <sup>1</sup> .....	.25 to .29		

## POTASH, CARBONATE, CALCINED (96 to 98 per cent).

[Per pound, New York, spot.]

Jan. 2, 1912.....	\$0.025 to \$0.0475	Sept. 27, 1915.....	\$0.28 to \$0.30
Apr. 2, 1912.....	.025 to .0475	Jan. 3, 1916.....	.45 to .50
July 1, 1912.....	.025 to .0475	Apr. 3, 1916.....	1.10
Sept. 30, 1912.....	.025 to .0475	July 3, 1916.....	.95 to 1.00
Dec. 30, 1912.....	.025 to .0475	Oct. 2, 1916.....	.60
Mar. 28, 1912.....	.022 to .0475	Jan. 1, 1917.....	.50 to .60
June 30, 1913.....	.0115 to .0450	Apr. 2, 1917 <sup>1</sup> .....	.70
Sept. 29, 1913.....	.025 to .0450	July 2, 1917 <sup>4</sup> .....	.70
Dec. 29, 1913.....	.025 to .0450	Oct. 1, 1917 <sup>4</sup> .....	.70
Mar. 29, 1914.....	.044 to .044	Dec. 31, 1917.....	.60 to .80
June 29, 1914.....	.044 to .044	April, 1918.....	.65 to .85
Sept. 28, 1914.....	.019	July 1, 1918.....	.65 to .75
Dec. 28, 1914.....	.0725 to .08	October, 1918.....	.55 to .75
Mar. 29, 1915.....	.180 to .1850	January, 1919.....	.40
June 28, 1915.....	.28	April, 1919.....	.26 to .28

<sup>1</sup> Per cent not stated.<sup>2</sup> 90 per cent.<sup>3</sup> Bulk.<sup>4</sup> Cyanide mixture.<sup>5</sup> U. S. P. Inner price, nominal.<sup>6</sup> Nominal.

## WHOLESALE PRICES OF POTASH—Continued.

## POTASH, CARBONATE, CALCINED (80 TO 85 PER CENT).

[Per pound, New York, spot.]

Jan. 2, 1912.....	\$0.034 to \$0.04	June 28, 1915.....	\$0.20
Apr. 1, 1912.....	.034 to .04	Sept. 27, 1915.....	.24 to .24
July 1, 1912.....	.034 to .04	Jan. 3, 1916.....	.45 to .50
Sept. 30, 1912.....	.034 to .04	Apr. 3, 1916.....	.90
Dec. 30, 1912.....	.34 to .34	July 3, 1916.....	.80 to .83
Mar. 31, 1913.....	.34 to .34	Oct. 2, 1916.....	.50
June 30, 1913.....	.34 to .34	Jan. 1, 1917.....	.38 to .40
Sept. 29, 1913.....	.34 to .34	Apr. 3, 1917.....	.35 to .40
Dec. 29, 1913.....	.35 to .35	July 2, 1917.....	.45
Mar. 30, 1914.....	.34 to .34	Oct. 1, 1917.....	.50
June 29, 1914.....	3 to 3	Dec. 31, 1917.....	.50 to .55
Sept. 28, 1914.....	.17	Apr. 1, 1918.....	.40 to .45
Dec. 28, 1914.....	6 to 7	July 1, 1918.....	.38 to .40
Mar. 29, 1915.....	.14 to 14		

## POTASH, CHLORATE CRYSTALS.

[Per pound, New York, spot.]

Jan. 2, 1912 <sup>1</sup> .....	\$0.083 to \$0.094	Jan. 3, 1916.....	\$0.45 to \$0.50
Apr. 1, 1912 <sup>1</sup> .....	.084 to .094	Apr. 3, 1916.....	.75
July 1, 1912 <sup>1</sup> .....	.084 to .094	July 3, 1916.....	.53 to .70
Sept. 30, 1912 <sup>1</sup> .....	.084 to .094	Oct. 2, 1916.....	.48 to .70
Dec. 30, 1912.....	.084 to .094	Jan. 1, 1917.....	.65 to .70
Mar. 31, 1913.....	.084 to .094	Apr. 2, 1917.....	.60 to .70
June 30, 1913.....	.084 to .094	July 2, 1917.....	.55 to .75
Sept. 29, 1913.....	.084 to .094	Oct. 1, 1917.....	.57 to .60
Dec. 29, 1913.....	.074 to .074	Dec. 31, 1917.....	.40 to .41
Mar. 30, 1914.....	.074 to .074	Apr. 8, 1918.....	.41 to .42 <sup>2</sup>
June 29, 1914.....	.074 to .074	July 1, 1918.....	.39 to .41
Dec. 28, 1914.....	15	October, 1918.....	.40 to .41
Mar. 29, 1915.....	25 to 30	January, 1919.....	.39 to .41
June 28, 1915.....	.30 to .30 <sup>3</sup>	April, 1919.....	.40
Sept. 27, 1915.....	.34 to .35		

## POTASH, CARBONATE, HYDRATED (80 TO 85 PER CENT).

[Per pound, New York, spot.]

Jan. 1, 1912.....	\$0.034 to \$0.044	June 28, 1915.....	\$0.20
Apr. 1, 1912.....	.034 to .044	Sept. 27, 1915.....	.24 to \$0.25
July 1, 1912.....	.30 to .44	Jan. 3, 1916.....	.45 to .50
Sept. 30, 1912.....	.034 to .044	Apr. 3, 1916.....	1.15
Dec. 30, 1912.....	.034 to .044	July 3, 1916.....	.95 to 1.00
Mar. 31, 1913.....	.034 to .044	Oct. 2, 1916.....	.70
June 30, 1913.....	.034 to .044	Jan. 1, 1917.....	.55 to .65
Sept. 29, 1913.....	.034 to .044	Dec. 31, 1917 <sup>2</sup> .....	1.00 to 1.25
Dec. 29, 1913.....	.034 to .044	Apr. 8, 1918 <sup>2</sup> .....	1.00 to 1.25
Mar. 28, 1914.....	.034 to .044	July, 1918.....	Nominal.
June 29, 1914.....	.034 to .044	October, 1918.....	.85 to .95
Sept. 28, 1914.....	.22	January, 1919.....	.85 to .95
Mar. 29, 1915.....	.16 to .17	April, 1919.....	.80 to .90

## POTASH, IODIDE, BULK.

[Per pound, New York, spot.]

Jan. 1, 1912.....	\$2.10 to \$2.15	Sept. 27, 1915.....	\$3.70 to \$3.75
Apr. 1, 1912.....	2.10 to 2.15	Jan. 3, 1916.....	3.70 to 3.75
July 1, 1912.....	2.40 to 2.45	Apr. 3, 1916.....	4.30 to 4.35
Sept. 30, 1912.....	2.60 to 2.65	July 3, 1916.....	3.90 to 3.95
Dec. 30, 1912.....	2.60 to 2.65	Oct. 2, 1916.....	3.75 to 3.80
Mar. 31, 1913.....	2.60 to 2.65	Jan. 1, 1917.....	3.45 to 3.50
June 30, 1913.....	2.60 to 2.65	Apr. 2, 1917.....	2.90 to 2.95
Sept. 29, 1913.....	2.95 to 3.00	July 2, 1917.....	2.90 to 2.95
Dec. 29, 1913.....	2.95 to 3.00	Oct. 1, 1917.....	2.90 to 2.95
Mar. 28, 1914.....	2.95 to 3.00	Dec. 31, 1917 <sup>2</sup> .....	3.75 to 3.80
June 29, 1914.....	2.95 to 3.00	Apr. 8, 1918 <sup>2</sup> .....	3.75 to 3.80
Sept. 28, 1914.....	3.15 to 3.20	July, 1918 <sup>2</sup> .....	3.75 to 3.80
Dec. 28, 1914.....	3.15 to 3.20	October, 1918.....	3.75 to 3.80
Mar. 29, 1915.....	3.15 to 3.20	January, 1919.....	3.50 to 3.55
June 28, 1915.....	3.15 to 3.20	April, 1919.....	3.60 to 3.65

<sup>1</sup> F. o. b. works.<sup>2</sup> Carbonate, hydrated.<sup>3</sup> Listed "Iodine, potassium."

## THE POTASH INDUSTRY.

## WHOLESALE PRICES OF POTASH—Continued.

## MURIATE OF POTASH (80 to 85 per cent; basis, 80 per cent).

[Per ton, New York, spot.]

Jan. 2, 1912.....	\$38.05	Sept. 27, 1915.....	\$245.00 to \$250.00
Apr. 1, 1912.....	38.05	Jan. 3, 1916.....	475.00 to 500.00
July 1, 1912.....	38.55	Apr. 3, 1916.....	415.00 to 420.00
Sept. 30, 1912.....	38.55	July 3, 1916.....	290.00 to 350.00
Dec. 30, 1912.....	38.55	Oct. 2, 1916.....	400.00 to 420.00
Mar. 31, 1913.....	38.55	Jan. 1, 1917.....	450.00 to 460.00
June 30, 1913.....	38.55	Apr. 2, 1917.....	425.00 to 450.00
Sept. 29, 1913.....	38.65	July 2, 1917.....	350.00 to 360.00
Dec. 29, 1913.....	38.65	Oct. 1, 1917.....	325.00 to 350.00
Mar. 30, 1914.....	39.07	Dec. 31, 1917.....	350.00
June 29, 1914.....	39.07	April, 1918.....	345.00 to 350.00
Sept. 28, 1914.....	39.57	July 1, 1918.....	310.00
Dec. 2, 1914.....	39.57	October, 1918.....per pound..	2.60 to 3.10
Mar. 29, 1915.....	160.00	January, 1919.....do....	2.60 to 3.10
June 28, 1915.....	\$230.00 to 250.00	April, 1919.....do....	2.60 to 2.75

## MURIATE OF POTASH (MINIMUM, 95 PER CENT; BASIS, 80 PER CENT).

[Per ton, New York, spot.]

Jan. 2, 1912.....	\$39.05	Sept. 27, 1915.....	(1)
Apr. 1, 1912.....	39.65	Jan. 3, 1916.....	(1)
July 1, 1912.....	40.15	Apr. 3, 1916.....	(1)
Sept. 30, 1912.....	40.15	July 3, 1916.....	\$300.00 to 310.00
Dec. 30, 1912.....	40.15	Oct. 2, 1916.....	375.00
Mar. 31, 1913.....	40.15	Jan. 1, 1917.....	375.00
June 30, 1913.....	40.15	Apr. 2, 1917.....	375.00
Sept. 29, 1913.....	40.15	July 2, 1917.....	360.00
Dec. 29, 1913.....	40.15	Oct. 1, 1917.....	(1)
Mar. 30, 1914.....	40.75	Dec. 31, 1917.....	(1)
June 29, 1914.....	40.75	April, 1, 1918.....	(1)
Sept. 28, 1914.....	41.25	July 1, 1918.....	325.00
Dec. 28, 1914.....	41.25	October, 1918.....per pound..	2.60 to 3.25
Mar. 29, 1915.....	160.00	January, 1919.....do....	2.60 to 3.25
June 28, 1915.....	\$230.00 to 250.00	April, 1919.....do....	2.60 to 2.75

## MURIATE OF POTASH (MINIMUM, 98 PER CENT; BASIS, 80 PER CENT).

[Per ton, New York, spot.]

Jan. 2, 1912.....	\$40.50	Sept. 27, 1915.....	(1)
Apr. 1, 1912.....	40.50	Jan. 3, 1916.....	(1)
July 1, 1912.....	41.00	Apr. 3, 1916.....	(1)
Sept. 30, 1912.....	41.00	July 3, 1916.....	(1)
Dec. 30, 1912.....	41.00	Oct. 2, 1916.....	(1)
Mar. 31, 1913.....	41.00	Jan. 1, 1917.....	(1)
June 30, 1913.....	41.00	Apr. 2, 1917.....	(1)
Sept. 29, 1913.....	41.00	July 2, 1917.....	(1)
Dec. 29, 1913.....	41.00	Oct. 1, 1917.....	(1)
Mar. 30, 1914.....	41.65	Dec. 31, 1917.....	(1)
June 29, 1914.....	41.65	April, 1918.....	(1)
Sept. 28, 1914.....	42.15	July 1, 1918.....	\$325.00
Dec. 28, 1914.....	42.15	October, 1918.....per pound..	2.60 to 3.25
Mar. 29, 1915.....	160.00	January, 1919.....do....	2.60 to 3.25
June 28, 1915.....	\$230.00 to 250.00	April, 1919.....do....	2.60

## POTASH, PERMANGANATE.

[Per pound, New York, spot.]

Jan. 1, 1912.....	\$0.09 <sup>1</sup> to \$0.10 <sup>1</sup>	Sept. 27, 1915.....	\$1.15
Apr. 1, 1912.....	.09 <sup>1</sup> to .10	Jan. 3, 1916.....	1.75
July 1, 1912.....	.09 <sup>1</sup> to .10	Apr. 3, 1916.....	\$1.90 to 2.05
Sept. 30, 1912.....	.09 <sup>1</sup> to .10	July 3, 1916.....	1.60 to 1.70
Dec. 30, 1912.....	.09 <sup>1</sup> to .10	Oct. 2, 1916.....	1.75 to 2.00
Mar. 31, 1912.....	.09 <sup>1</sup> to .10	Jan. 1, 1917.....	2.75 to 3.00
June 30, 1912.....	.09 <sup>1</sup> to .10	Apr. 12, 1917.....	3.50 to 4.00
Sept. 29, 1912.....	.09 <sup>1</sup> to .10	July 2, 1917.....	4.00 to 4.50
Dec. 29, 1913.....	.09 <sup>1</sup> to .10	Oct. 1, 1917.....	4.00 to 4.25
Mar. 28, 1914.....	.09 <sup>1</sup> to .10	Dec. 31, 1917.....	4.00 to 4.10
June 29, 1914.....	.09 <sup>1</sup> to .10	April, 1918.....	4.00 to 4.10
Sept. 28, 1914.....	.55 to .60	July 1, 1918.....	2.00 to 3.75
Dec. 28, 1914.....	.14 to .15	October, 1918.....	1.75 to 2.00
Mar. 29, 1915.....	.55 to .65	January, 1919.....	1.35 to 1.60
June 28, 1915.....	.70 to .72 <sup>1</sup>	April, 1919.....	.60 to .70

<sup>1</sup> Nominal.

## WHOLESALE PRICES OF POTASH—Continued.

## POTASH, CHLORATE, POWDERED.

[Per pound, New York, spot.]

Jan. 2, 1912.....	\$0.08 <sup>4</sup> to \$0.09 <sup>4</sup>	Jan. 3, 1916.....	\$0.45 to \$0.50
Apr. 1, 1912.....	.08 <sup>4</sup> to .09 <sup>4</sup>	Apr. 3, 1916.....	.75
July 1, 1912.....	.08 <sup>4</sup> to .09 <sup>4</sup>	July 3, 1916.....	.53 to .70
Sept. 30, 1912.....	.08 <sup>4</sup> to .09 <sup>4</sup>	Oct. 2, 1916.....	.48 to .70
Dec. 30, 1912.....	.08 <sup>4</sup> to .09 <sup>4</sup>	Jan. 1, 1917.....	.65 to .70
Mar. 31, 1913.....	.08 <sup>4</sup> to .09 <sup>4</sup>	Apr. 2, 1917.....	.60 to .70
June 30, 1913.....	.08 <sup>4</sup> to .09 <sup>4</sup>	July 2, 1917.....	.55 to .75
Sept. 29, 1913.....	.08 <sup>4</sup> to .09 <sup>4</sup>	Oct. 1, 1917.....	.57 <sup>4</sup> to .60
Dec. 29, 1913.....	.07 <sup>4</sup> to .08 <sup>4</sup>	Dec. 31, 1917.....	.40 to .41
Mar. 30, 1914.....	.07 <sup>4</sup> to .08 <sup>4</sup>	April, 1918.....	.41 to .42
June 29, 1914.....	.07 <sup>4</sup> to .08 <sup>4</sup>	July, 1918.....	.39 to .41
Dec. 28, 1914.....	.15 <sup>4</sup>	October, 1918.....	.40 to .41
Mar. 29, 1915.....	.25 to .30	January, 1919.....	.39 to .41
June 28, 1915.....	.30 to .30 <sup>4</sup>	April, 1919.....	.40
Sept. 27, 1915.....	.34 to .35		

## PRUSSIATE OF POTASH, RED.

[Per pound, New York, spot.]

Jan. 1, 1912.....	\$0.26 to \$0.30	June 28, 1915.....	\$1.25
Apr. 1, 1912.....	.26 to .30	Sept. 27, 1915.....	2.35
July 1, 1912.....	.26 to .30	Jan. 3, 1916.....	5.00
Sept. 30, 1912.....	.28 to .32	Oct. 2, 1916.....	\$1.75 to 2.00
Dec. 30, 1912.....	.33	Jan. 1, 1917.....	2.50 to 3.00
Mar. 31, 1913.....	.33	July 2, 1917.....	2.75 to 2.90
June 30, 1913.....	.33	Oct. 1, 1917.....	2.80 to 2.95
Sept. 29, 1913.....	.33	Dec. 31, 1917.....	2.65 to 3.00
Dec. 29, 1913.....	.23	Apr. 8, 1918.....	2.80 to 2.90
Mar. 28, 1914.....	.21 <sup>4</sup>	July, 1918.....	2.60 to 2.70
June 29, 1914.....	.21 to .23	October, 1918.....	2.30 to 2.50
Dec. 28, 1914.....	.55	January, 1919.....	2.00 to 2.25
Mar. 29, 1915.....	.55	April, 1919.....	1.00 to 1.25

## PRUSSIATE OF POTASH, YELLOW.

[Per pound, New York, spot.]

Jan. 1, 1912.....	\$0.18 <sup>4</sup> to \$0.18 <sup>4</sup>	Sept. 27, 1915.....	\$0.82 <sup>4</sup> to \$0.85
Apr. 1, 1912.....	.18 <sup>4</sup> to .18 <sup>4</sup>	Jan. 3, 1916.....	.90 to 1.00
July 1, 1912.....	.14	Apr. 3, 1916.....	1.75 to 1.80
Sept. 30, 1912.....	.18 to .20	July 3, 1916.....	1.20 to 1.30
Dec. 30, 1912.....	.18 to .22	Oct. 2, 1916.....	.65 to .75
Mar. 31, 1913.....	.18 <sup>4</sup> to .19	Jan. 1, 1917.....	.92 to .95
June 30, 1913.....	.18 to .18	July 2, 1917.....	1.00 to 1.05
Sept. 29, 1913.....	.18 <sup>4</sup> to .17 <sup>4</sup>	Oct. 1, 1917.....	1.25
Dec. 29, 1913.....	.18 <sup>4</sup>	Dec. 31, 1917.....	1.25 to 1.30
Mar. 28, 1914.....	.13 to .18	Apr. 8, 1918.....	1.25 to 1.27
June 29, 1914.....	.12 <sup>4</sup> to .12 <sup>4</sup>	July, 1918.....	1.05 to 1.10
Sept. 28, 1914.....	.24 to .36	October, 1918.....	.95 to 1.00
Dec. 28, 1914.....	.22 to .24	January, 1919.....	.75 to .80
Mar. 28, 1915.....	.42 to .48	April, 1919.....	.50 to .55
June 28, 1915.....	.75 to .90		

## SULPHATE OF POTASH 90 TO 95 PER CENT; BASIS, 90 PER CENT.

Jan. 1, 1912.....	per ton. \$46.30	Sept. 27, 1915.....	per ton. \$208.00 to \$210.00
Apr. 1, 1912.....	do.....	Jan. 3, 1916.....	44.00
July 1, 1912.....	do.....	Apr. 3, 1916.....	325.00 to 350.00
Sept. 30, 1912.....	do.....	July 3, 1916.....	275.00 to 300.00
Dec. 30, 1912.....	do.....	Oct. 2, 1916.....	275.00 to 300.00
Mar. 31, 1913.....	do.....	Jan. 1, 1917.....	275.00 to 300.00
June 30, 1913.....	do.....	Apr. 2, 1917.....	275.00 to 300.00
Sept. 29, 1913.....	do.....	July 2, 1917.....	275.00 to 300.00
Dec. 29, 1913.....	do.....	Oct. 1, 1917.....	300.00
Mar. 28, 1914 <sup>1</sup> .....	do.....	Dec. 31, 1917.....	350.00 to 400.00
June 29, 1914.....	do.....	Apr. 1, 1918.....	375.00 to 400.00
Sept. 28, 1914.....	do.....	July 1, 1918.....	350.00
Dec. 28, 1914.....	do.....	October, 1918.....	3.25 to 3.50
Mar. 28, 1915.....	do.....	January, 1919.....	3.00
June 28, 1915.....	do.....	April, 1919.....	2.25

<sup>1</sup>In bags.

## WHOLESALE PRICES OF POTASH—Continued.

## DOUBLE MANURE SALT (48 TO 53 PER CENT; BASIS, 48 PER CENT).

[Per ton, New York, spot.]

Jan. 1, 1912.....	\$24.45	June 28, 1915 <sup>1</sup> .....	\$57.00
Apr. 1, 1912.....	24.45	Sept. 27, 1915.....	105.00
July 1, 1912.....	24.95	Jan. 3, 1916.....	105.00
Sept. 30, 1912.....	24.95	Apr. 3, 1916.....	105.00
Dec. 30, 1912.....	24.95	July 3, 1916.....	105.00
Mar. 31, 1913.....	24.95	Oct. 2, 1916.....	105.00
June 30, 1913.....	24.95	Jan. 1, 1917.....	105.00
Sept. 29, 1913.....	24.95	Apr. 2, 1917.....	105.00
Dec. 29, 1913.....	24.95	July 2, 1917.....	105.00
Mar. 29, 1914 <sup>1</sup> .....	25.04	Oct. 1, 1917.....	(3)
June 29, 1914 <sup>1</sup> .....	25.04	Dec. 31, 1917.....	(3)
Sept. 28, 1914.....	25.54	April, 1918.....	(3)
Dec. 28, 1914.....	25.54	July, 1918.....	(3)
Mar. 29, 1915 <sup>1</sup> .....	55.00		

MANURE SALT (MINIMUM, 30 PER CENT K<sub>2</sub>O IN BULK).

[Per ton, New York, spot.]

Jan. 1, 1912.....	\$13.30	June 28, 1915.....	\$50.00
Apr. 1, 1912.....	13.30	Sept. 27, 1915.....	60.00
July 1, 1912.....	13.50	Jan. 3, 1916.....	60.00
Sept. 30, 1912.....	13.50	Apr. 3, 1916.....	\$50.00 to 60.00
Dec. 30, 1912.....	13.50	July 3, 1916.....	50.00 to 60.00
Mar. 31, 1913.....	13.50	Oct. 2, 1916.....	50.00 to 60.00
June 30, 1913.....	13.50	Jan. 1, 1917.....	50.00 to 60.00
Sept. 29, 1913.....	13.50	Apr. 2, 1917.....	50.00 to 60.00
Dec. 29, 1913.....	13.50	July 2, 1917.....	50.00 to 60.00
Mar. 28, 1914.....	13.58	Oct. 1, 1917.....	(3)
June 29, 1914.....	13.58	Dec. 31, 1917.....	(3)
Sept. 24, 1914.....	13.78	April, 1918.....	(3)
Dec. 28, 1914.....	13.78	July, 1918.....	(3)
Mar. 29, 1915.....	27.00		

HARD SALT (MINIMUM 16 PER CENT, K<sub>2</sub>O IN BULK).

[Per ton, New York, spot.]

Jan. 1, 1912.....	\$10.65	June 28, 1915.....	\$40.00 to \$50.00
Apr. 1, 1912.....	10.65	Sept. 27, 1915.....	40.00 to 50.00
July 1, 1912.....	10.85	Jan. 3, 1916.....	40.00 to 50.00
Sept. 30, 1912.....	10.85	Apr. 3, 1916.....	40.00 to 50.00
Dec. 30, 1912.....	10.85	July 3, 1916.....	40.00 to 50.00
Mar. 31, 1913.....	10.85	Oct. 2, 1916.....	40.00 to 50.00
June 30, 1913.....	10.85	Jan. 1, 1917.....	40.00 to 50.00
Sept. 29, 1913.....	10.85	July 2, 1917.....	40.00 to 50.00
Dec. 29, 1913.....	10.85	Oct. 1, 1917.....	(3)
Mar. 28, 1914.....	10.87	Dec. 31, 1917.....	(3)
June 29, 1914.....	10.87	April, 1918.....	(3)
Sept. 28, 1914.....	11.07	July, 1918.....	(3)
Dec. 28, 1914.....	11.07		

KAINITE (MINIMUM, 12.4 PER CENT, K<sub>2</sub>O IN BULK).

[Per ton, New York, spot.]

Jan. 1, 1912.....	\$8.25	Dec. 28, 1914.....	\$8.50
Apr. 1, 1912.....	8.25	Sept. 27, 1915.....	40.00 to 50.00
July 1, 1912.....	8.45	Jan. 3, 1916.....	40.00 to 50.00
Sept. 30, 1912.....	8.45	Apr. 3, 1916.....	40.00 to 50.00
Dec. 30, 1912.....	8.45	July 3, 1916.....	40.00 to 50.00
Mar. 31, 1913.....	8.45	Oct. 2, 1916.....	40.00 to 50.00
June 30, 1913.....	8.45	Jan. 1, 1917.....	40.00 to 50.00
Sept. 29, 1913.....	8.45	July 2, 1917.....	40.00 to 50.00
Dec. 29, 1913.....	8.45	Oct. 1, 1917.....	(3)
Mar. 28, 1914.....	8.45	Dec. 31, 1917.....	(3)
June 29, 1914.....	8.36	April, 1918.....	(3)
Sept. 28, 1914.....	8.36	July, 1918.....	(3)

## SALTPETER, CRUDE.\*

[Per pound, New York, spot.]

Jan. 1, 1912.....	\$0.04 to \$0.05	June 30, 1913.....	\$0.05
Apr. 1, 1912.....	.04 to .05	Sept. 29, 1913.....	.04 to .04
July 1, 1912.....	.04 to .05	Dec. 29, 1913.....	.04 to .04
Sept. 30, 1912.....	.05	Mar. 30, 1914.....	.04 to .05
Dec. 30, 1912.....	.05	June 29, 1914.....	.04 to .05
Mar. 31, 1912.....	.05		

<sup>1</sup> In bags.<sup>2</sup> Nominal.<sup>3</sup> Not listed since 1914.

## WHOLESALE PRICES OF POTASH—Continued.

## SALTPETER, REFINED.

(Per pound, New York, spot.)

Jan. 1, 1912.....	.30 04 to .30 06	Mar. 29, 1915.....	.60 09 to .60 10 <sup>1</sup>
Apr. 1, 1912.....	.04 to .06	June 28, 1915.....	.18 to .16 <sup>1</sup>
July 1, 1912.....	.05 to .06 <sup>1</sup>	Sept. 27, 1915.....	.18 to .19
Sept. 30, 1912.....	.05 to .06 <sup>1</sup>	Jan. 3, 1916.....	.35 to .38
Dec. 30, 1912.....	.05 to .06 <sup>1</sup>	Apr. 3, 1916.....	.35 to .38
Mar. 31, 1913.....	.05 to .06 <sup>1</sup>	July 3, 1916.....	.29 <sup>1</sup> to .30 <sup>1</sup>
June 30, 1913.....	.05 to .06 <sup>1</sup>	Oct. 2, 1916.....	.28 to .30
Sept. 29, 1913.....	.05 to .06 <sup>1</sup>	Jan. 1, 1917.....	.31 to .35
Dec. 29, 1913.....	.05 to .06 <sup>1</sup>	Apr. 2, 1917.....	.31 to .38
Mar. 30, 1914.....	.04 to .06 <sup>1</sup>	July 2, 1917.....	.31 and .38
June 29, 1914.....	.04 to .05 <sup>1</sup>	Dec. 31, 1917.....	( <sup>1</sup> )
Sept. 28, 1914.....	.09 to .10	Apr. 8, 1918.....	.31 to .31 <sup>1</sup>
Dec. 28, 1914.....	.07 to .08		

## RATES OF DUTY ON INDIVIDUAL SALTS.

## POTASH, BICARBONATE OF, REFINED.

Act of—	Para-graph.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1883.....	73	Potash, bicarbonate of, or supercarbonate of, and saleratus, calcined or pearl ash.	1½ cents per pound.
1890.....	76	All chemical compounds and salts, n. s. p. f.....	25 per cent ad valorem.
1894.....	60	....do.....	Do.
1897.....	3	....do.....	Do.
1909.....	3	All chemical compounds, mixtures, and salts, n. s. p. f.....	Do.
1913.....	64	Potash, bicarbonate of, refined.....	½ cent per pound.

## POTASH, CARBONATE OF, CRUDE (OR BLACK SALTS).

1883.....	63	Potash, crude, carbonate of, or fused.....	20 per cent ad valorem.
1890.....	688	Potash, crude, carbonate of, or "black salts".....	Free.
1894.....	595	....do.....	Do.
1897.....	644	Potash, crude, or "black salts"; carbonate of potash, crude or refined.....	Do.
1909.....	665	....do.....	Do.
1913.....	580	Potash, crude, or "black salts," carbonate of.....	Do.

## POTASH, CHLORATE OF.

1883.....	64	Potash, chlorate of.....	3 cents per pound.
1890.....	688	Chlorate of potash.....	Free.
1894.....	595	....do.....	Do.
1897.....	63	Potash, chlorate of.....	25 cents per pound.
1909.....	61	Chlorate of potash.....	2 cents per pound.
1913.....	64	Potash, chlorate of.....	½ cent per pound.

## POTASH, CHROMATE AND BICHROMATE OF.

1883.....	48	Chromate of potash.....	3 cents per pound.
	49	Bichromate of potash.....	Do.
1890.....	69	Potash, bichromate and chromate of.....	Do.
1894.....	54	....do.....	25 per cent ad valorem.
1897.....	62	....do.....	3 cents per pound.
1909.....	60	....do.....	24 cents per pound.
1913.....	64	Potash, chromate and bichromate of.....	1 cent per pound.

## POTASH, CYANIDE OF.

1883.....	92	All chemical compounds and salts, by whatever name known, and not specially enumerated or provided for in this act.	25 per cent ad valorem.
1890.....	76	All chemical compounds and salts, n. s. p. f.....	Do.
1894.....	60	....do.....	Do.
1897.....	66	Cyanide of potassium.....	12½ per cent ad valorem.
1909.....	64	Cyanide of potassium.....	Do.
1913.....	580	Potash, cyanide of.....	Free.

<sup>1</sup> Not listed.<sup>2</sup> Carbonate of potash was held under the act of 1894 to include both the impure and refined. (T. D. 17430, G. A. 3604; 19067, G. A. 4087; following United States v. Glese, 83 Fed., 692.)

## THE POTASH INDUSTRY.

## RATES OF DUTY ON INDIVIDUAL SALTS—Continued.

## POTASH, HYDRATE OF.

Act of—	Para-graph.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1883.....	63	Caustic potash (no specific provision for hydrate of potash).....	20 per cent ad valorem.
1890.....	70	Potash, caustic or hydrate of, refined, in sticks or rolls.....	1 cent per pound.
	685	Caustic potash, or hydrate of, not including refined, in sticks or rolls.	Free.
1894.....	595	Caustic potash, or hydrate of, including refined, in sticks or rolls.	Do.
1897.....	63	Potash, caustic or hydrate of, refined, in sticks or rolls.....	1 cent per pound.
	644	Potash, hydrate of, or caustic potash, not including refined, in sticks or rolls.	Free.
1909.....	61	Caustic, or hydrate of potash, refined, in sticks or rolls.....	1 cent per pound.
	655	Potash, hydrate of, or caustic potash, not including refined, in sticks or rolls. Where there is less than 50 per cent of caustic potash or more than 10 per cent of soda, dutiable as chemical mixture or combination of alkalies under paragraph 3. (Dept. Order, T. D. 32440.)	Free.
1913.....	580	Potash, hydrate of, when not containing more than 15 per cent of caustic soda.	Do.
	5	Potash, hydrate of, when containing more than 15 per cent of caustic soda is not specifically provided for and falls within paragraph 5 for chemical compounds or salts, n. s. p. f.	15 per cent ad valorem.

## POTASH, HYDRIODATE OF.

1883.....	65	Potash, hydriodate.....	50 cents a pound.
1890.....	71	.....do.....	Do.
1894.....	55	.....do.....	25 cents a pound.
1897.....	64	.....do.....	Do.
1909.....	62	.....do.....	Do.
1913.....	5	All chemical and medicinal compounds, preparations, mixtures and salts, and combinations thereof, n. s. p. f.	15 per cent ad valorem.

## POTASH, IODATE OF.

1883.....	65	Potash, iodate.....	50 cents per pound.
1890.....	71	.....do.....	Do.
1894.....	55	.....do.....	25 cents per pound.
1897.....	64	.....do.....	Do.
1909.....	62	.....do.....	Do.
1913.....	5	All chemical and medicinal compounds, preparations, mixtures and salts, and combinations thereof, n. s. p. f.	15 per cent ad valorem.

## POTASSIUM IODIDE.

1883.....	65	Potash, iodide .....	50 cents per pound.
1890.....	71	.....do.....	Do.
1894.....	55	.....do.....	25 cents per pound.
1897.....	64	.....do.....	Do.
1909.....	62	.....do.....	Do.
1913.....	38	Potassium iodide.....	15 cents per pound.

## POTASH, MURIATE OF.

1883.....	627	Potash, muriate of.....	Free.
1890.....	635	Muriate of potash.....	Do.
1894.....	595	.....do.....	Do.
1897.....	644	.....do.....	Do.
1909.....	655	.....do.....	Do.
1913.....	580	Potash, muriate of.....	Do.

**THE POTASH INDUSTRY.**

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**RATES OF DUTY—Continued.**

**POTASH, NITRATE OF, CRUDE.**

Act of—	Para-graph.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1883.....	68	Potash, nitrate of, or saltpeter, crude.....	1 cent per pound.
1890.....	685	Nitrate of potash, or saltpeter, crude.....	Free.
1894.....	595	.....do.....	Do.
1897.....	644	.....do.....	Do.
1909.....	655	.....do.....	Do.
1913.....	580	Potash, nitrate of, or saltpeter, crude.....	Do.

**POTASH, NITRATE OF, REFINED.**

1883.....	69	Potash, nitrate of, or refined saltpeter.....	1½ cents per pound.
1890.....	72	Potash, nitrate of, or saltpeter, refined.....	1 cent per pound.
1894.....	56	.....do.....	½ cent per pound.
1897.....	65	.....do.....	Do.
1909.....	63	Nitrate of potash, or saltpeter, refined.....	Do.
1913.....	64	Potash, nitrate of, or saltpeter, refined.....	\$7 per ton.

**POTASH, PERMANGANATE OF.**

1883.....	92	All chemical compounds and salts, by whatever name known and not specially enumerated or provided for in this act.	25 per cent ad valorem.
1890.....	76	All chemical compounds and salts, n. s. p. f.....	Do.
1894.....	60	.....do.....	Do.
1897.....	3	.....do.....	Do.
1909.....	3	All chemical compounds, mixtures, and salts, n. s. p. f.....	Do.
1913.....	64	Potash, permanganate of.....	1 cent per pound.

**POTASH, PRUSSIATE OF, RED.**

1883.....	66	Potash, prussiate of, red.....	10 cents per pound.
1890.....	73	.....do.....	Do.
1894.....	57	.....do.....	25 per cent ad valorem.
1897.....	66	.....do.....	8 cents per pound.
1909.....	64	.....do.....	Do.
1913.....	64	.....do.....	2 cents per pound.

**POTASH, PRUSSIATE OF, YELLOW.**

1883.....	67	Potash, prussiate of, yellow.....	5 cents per pound.
1890.....	73	.....do.....	Do.
1894.....	57	.....do.....	25 per cent ad valorem.
1897.....	66	.....do.....	4 cents per pound.
1909.....	64	.....do.....	Do.
1913.....	64	.....do.....	1½ cents per pound.

**POTASH, SULPHATE OF.**

1883.....	70	Potash, sulphate of.....	20 per cent ad valorem.
1890.....	685	Sulphate of potash, crude or refined.....	Free.
1894.....	595	.....do.....	Do.
1897.....	644	.....do.....	Do.
1909.....	655	.....do.....	Do.
1913.....	580	Potash, sulphate of.....	Do.

**TARTRATE OF SODA AND POTASSA AND ROCHELLE SALTS.**

1883.....	29	Soda and potassa tartrate, or Rochelle salt.....	3 cents per pound.
1890.....	92	Tartrate of soda and potassa, or Rochelle salts.....	Do.
1894.....	75	.....do.....	2 cents per pound.
1897.....	6	.....do.....	4 cents per pound.
1909.....	6	.....do.....	3 cents per pound.
1913.....	8	.....do.....	4 cents per pound.
		Containing more than 90 per cent of bitartrate of potash.	2½ cents per pound.
		Rochelle salts, or tartrate of soda and potassa.....	

## THE POTASH INDUSTRY.

## RATES OF DUTY—Continued.

## KELP.

[Par. 523, act of 1913. Free.]

Act of—	Para-graph.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1883.....	2503	Kelp.....	Free.
1890.....	623	.....do.....	Do.
1894.....	524	.....do.....	Do.
1897.....	580	.....do.....	Do.
1909.....	601	.....do.....	Do.
1913.....	523	.....do.....	Do.

## KAINITE.

[Par. 525, act of 1913. Free.]

1883.....	516	Kyanite or cyanite, and kainite.....	Free.
1890.....	625	.....do.....	Do.
1894.....	526	.....do.....	Do.
1897.....	591	.....do.....	Do.
1909.....	604	.....do.....	Do.
1913.....	525	.....do.....	Do.

## COURT AND TREASURY DECISIONS.

## PERMANGANATE OF POTASH.

Permanganate of potassa, used almost exclusively as a disinfectant, was held dutiable under the provision in the act of 1861 for "all other salts and preparations of salts n. o. p. f." (Dept. Order, T. D. 1545.)

## POTASSIUM.

Merchandise described as "the elementary substance known as potassium, the metallic base of potash," was held dutiable as "metal, unwrought." (Appeal of Contanseau Rapid Foreign Express Co., T. D. 9324.)

## CYANIDE OF POTASSIUM.

Cyanide of potassium was held dutiable as a chemical salt not derived from coal tar under paragraph 60 of the act of 1894, and not exempt from duty as a coal-tar product or preparation under paragraph 443. (G. A. 3681, T. D. 17633.)

A mixture of cyanide of potassium and cyanide of sodium, known commercially as cyanide of potassium, was held dutiable as cyanide of potassium under paragraph 66 of the act of 1897, and not as a chemical salt, the provision being construed as not limited to the pure potassium cyanide. (G. A. 4777, T. D. 22521.)

This decision was followed under the act of 1909, notwithstanding the Government's contention that paragraph 3 of that act applied only to the pure cyanide of potassium used in medicine, as by virtue of the pure-food law the impure article is not permitted to be labeled or sold as cyanide of potassium. (Abstract 23365, T. D. 30645, followed in Abstract 23593, T. D. 30733; Abstract 24026, T. D. 30969; Abstract 24475, T. D. 31165; Abstract 24568, T. D. 31207; Abstract 27170, T. D. 32031; Abstract 30514, T. D. 32943; but not in Abstract 35678, T. D. 34468.)

An article containing 22 per cent of cyanide of potassium, 57 per cent of cyanide of sodium, and 21 per cent of other substances was held on the testimony to be commercially cyanide of potassium within paragraph 64 of the act of 1909, and therefore dutiable at 12½ per cent ad valorem and not at 25 per cent under paragraph 3 as a chemical compound, mixture, or salt. (Abstract 29723, T. D. 32823; Abstract 30109, T. D. 32858; G. A. 7571, T. D. 34495; Abstract 36943, T. D. 34933.)

So also was a substance composed of 10 per cent cyanide of potash and the remainder cyanide of soda. (Abstract 36046, T. D. 34609.)

G. A. 7571, T. D. 34495, supra, was also followed under the act of 1913. (Abstract 37164.)

#### CARBONATE OF POTASH.

An article consisting of carbonate, sulphate, and chloride of potassa, together with insoluble matter, containing more than 30 per cent of free potash and constituting the crude carbonate of potash, was held to be different from the black salts of commerce, which was declared to be the crude caustic potash from which the carbonate of potash is made by one process, whereas the caustic potash of commerce is made by another process. Classification was made under the Revised Statutes as an unenumerated manufactured article. (Dept. Order, T. D. 5096.)

Merchandise described as "a species of crude potash" was held dutiable under the act of 1883 as "potash, crude," and not exempt under the provision for "aniline salts or black salts and black tares," not being known in commerce as black salts and admittedly not an aniline salt. (Appeal, T. D. 8601.)

Carbonate of potash, crude, somewhat advanced toward the condition of pearlash and not so crude or dark colored as black salts, was held exempt from duty as crude carbonate of potash under the act of 1890 and not dutiable as refined. (G. A. 1249, T. D. 12565.)

Refined carbonate of potash was held exempt from duty under the provision in paragraph 595 of the act of 1894 for "potash, crude, carbonate of, or black salts," and not dutiable as a chemical salt. The Government contended that the word "crude" in paragraph 595 qualified the phrase "carbonate of, or black salts," and that the phrase "potash, crude, carbonate of, or black salts" covered only one product. The Board of General Appraisers held that the said terms should be applied distributively so as to provide for crude potash, carbonate of potash, and black salts. Its view was sustained by the Circuit Court for the Southern District of New York and by the Circuit Court of Appeals for the Second Circuit. (Dept. Order, T. D. 17380, 17381; G. A. 3604, T. D. 17430; U. S. v. Giese, 78 Fed., 805, T. D. 17900; 88 Fed., 692, T. D. 18810; G. A. 4087, T. D. 19067, overruling T. D. 17027.)

#### BICARBONATE OF POTASH.

Bicarbonate of potash was held dutiable under the Revised Statutes as a medicinal preparation. (Dept. Order, T. D. 4117.)

Bicarbonate of potash was held dutiable as a chemical salt under paragraph 76 of the act of 1890. (G. A. 548, T. D. 11189.)

## CAUSTIC POTASH.

Caustic potash, or hydrate of potash, was held not to assimilate in character and use to pearlash and to be dutiable as an unenumerated article under the Revised Statutes. (Dept. Order, T. D. 3940. Compare T. D. 420, holding calcined potash or hydrate of potash similar in character and use to pearlash and dutiable accordingly.)

So-called caustic potash, containing less than 50 per cent of caustic potash or more than 10 per cent of soda, was held dutiable under the act of 1909 as a chemical mixture or a combination of alkalies and not exempt from duty as caustic potash. (Dept. Order, T. D. 32440.)

Caustic potash may vary in purity from 40 to 98 per cent. An article showing by chemical analysis the presence of 39.85 per cent caustic potash was held to be the commercial article sold under that name and entitled to free entry under paragraph 655 of the act of 1909. (G. A. 7468, T. D. 33509.)

## NITRATE OF POTASH OR SALTPEETER.

Under the law providing separately for nitrate of potash, crude, partially refined, and refined, saltpeter was held dutiable as partially refined only when actual process of refinement had taken place since the first crystallization. Otherwise than in that form the article was classified as crude or as refined according to its condition. (T. D. 674 of 1870.)

## SULPHATE OF POTASH.

Sulphate of potash, the only common use of which, either by itself or in combination with other materials, is as a manure or in the manufacture of manure, was held exempt from duty under the act of 1883 as a substance expressly used for manure and not dutiable as sulphate of potash. (*Magona v. Heller*, 150 U. S., 70, remanding 38 Fed., 908; Dept. Order, T. D. 17718. Compare *Marine v. Bartol*, 60 Fed., 601, holding sulphate of ammonia used in the manufacture of fertilizers dutiable as sulphate of ammonia and not as a substance expressly used for manure.)

All substances, whether provided for by name or otherwise, which serve to enrich the soil were held to come within the provision in that act for substances expressly used for manure. (*Schultz v. Cadwaller*, 43 Fed., 290; 154 U. S., 496.)

## BISULPHITE OF POTASH.

Bisulphite of potash, classified by the collector as a chemical salt, was held to be a combination of an acid and an alkali base and not caustic or hydrate of potash, and hence not exempt from duty under the provision for "caustic potash, or hydrate of, not including refined in sticks or rolls," in the act of 1890. (G. A. 496, T. D. 11053.)

## POTASH WATER.

Potash water, an artificial mineral water, was held not exempt from duty under the act of 1894 as similar to lemonade and soda water. (G. A. 3619, T. D. 17480.)





